JONATHAN PRENTISS DOLLIVER, OF IOWA.

BORN NEAR KINGWOOD, PRESTON COUNTY, VA. (NOW WEST VIRGINIA), FEBRUARY 6, 1858.

DIED AT FORT DODGE, WEBSTER COUNTY, IOWA, OCTOBER 15, 1910.

Senator Dolliver represented the Tenth Congressional district of Iowa in the Fifty-first, Fifty-second, Fifty-third, Fifty-fourth, Fifty-fifth, and Fifty-sixth Congresses; was appointed United States Senator August 23, 1900, to fill the vacancy caused by the death of Hon. J. H. Gear; elected to succeed himself January 21, 1902, and reelected in 1907. His term would have expired March 3, 1913. Senator Dolliver succeeded, upon the retirement of Senator Hansbrough, to the chairmanship of the Senate Committee on Agriculture and Forestry, which position he held at the time of his death and filled with great acceptability to the Congress, the Department, and the country.

61st Congress, 3d Session | HOUSE OF REPRESENTATIVES | Document No. 1222

YEARBOOK

OF THE

UNITED STATES DEPARTMENT OF AGRICULTURE.

1910.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1911.

[CHAPTER 23, Stat. at L., 1895.]

[AN ACT Providing for the public printing and binding and the distribution of public documents.]

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Section 73, paragraph 2:

The Annual Report of the Secretary of Agriculture shall hereafter be submitted and printed in two parts, as follows: Part One, which shall contain purely business and executive matter which it is necessary for the Secretary to submit to the President and Congress; Part Two, which shall contain such reports from the different Bureaus and Divisions, and such papers prepared by their special agents, accompanied by suitable illustrations, as shall, in the opinion of the Secretary, be specially suited to interest and instruct the farmers of the country, and to include a general report of the operations of the Department for their information. There shall be printed of Part One, one thousand copies for the Senate, two thousand copies for the House, and three thousand copies for the Department of Agriculture; and of Part Two, one hundred and ten thousand copies for the use of the Senate, three hundred and sixty thousand copies for the use of the House of Representatives, and thirty thousand copies for the use of the Department of Agriculture, the illustrations for the same to be executed under the supervision of the Public Printer, in accordance with directions of the Joint Committee on Printing, said illustrations to be subject to the approval of the Secretary of Agriculture; and the title of each of the said parts shall be such as to show that such part is complete in itself.

PREFACE.

The Yearbook for 1910 closely follows, in the main, the style and character of its predecessors. The tendency to increase the size of the volume has been as vigorously resisted as possible, considering the excellent material available for use. This volume has been prepared in the usual way, which is as follows: Early in June the Secretary calls upon each chief of bureau, division, or office to furnish titles of articles, from which, early in July, he selects those which seem to him most timely and interesting, and authorizes the preparation and submission of the manuscripts not later than December 1 for examination and publication, if found available for such use. Then follow the editing, selection of illustrations, proof reading, indexing, and finally the distribution, which now begins early in May. During a considerable portion of the year, therefore, the Yearbook is in course of preparation or distribution.

This volume contains 28 articles, including a wide range of subjects, each closely related to or describing some line of work of the department. Both in the nature of the articles presented and in the manner of treating the subjects the controlling idea has been that of practical utility, while the statements are as brief and couched in language as simple as possible.

The statistical tables with which the Appendix closes present the domestic production, prices, and commercial movement of the principal crops and farm animals with greater fullness than heretofore, and in the tables for world's production all the improvements of last year's volume are retained. The statistical tables represent a work of great magnitude, and have required considerable time for the collection of data and for tabulation after the close of the calendar year.

An appreciation of the true meaning of statistics requires that they shall be regarded as round numbers, however accurately expressed on paper. The degree to which statistical items should be rounded depends upon the size and nature of the item. In making up the table showing the production of wheat in the United States it is found advisable, for the sake of accuracy, to use 1,000 bushels as the unit of measurement; but in comparing the entire crop of one year with that of another, a simple and accurate method is to take 1,000,000 bushels as the unit of measurement; thus, the crop of 1910

amounted to 695 million bushels, as compared with 730 million bushels the year before. The same principle applies to the use of other statistics.

The sources of the figures contained in this book are the most trustworthy to be had. Production, acreage, and farm prices were computed from reports made to this department by thousands of regular correspondents, scattered throughout the country. Exports and imports of the United States are taken from reports of the Department of Commerce and Labor, which in turn compiles its data from sworn statements made by persons who export or import, and statistics relating to foreign countries are taken from their official publications (except in a few instances where none are available) and reduced to United States units of weight and measurement.

The review of the weather conditions for the year covered by the volume has been greatly condensed, but it is believed that it will meet the requirements of all those accustomed to consult the Appendix of the Yearbook for such information.

The illustrations in the volume comprise 31 text figures and 49 full-page plates, 8 of the latter being colored.

The portrait of Hon. Jonathan Prentiss Dolliver, distinguished as a Representative and afterwards as a Senator in Congress from Iowa, has been selected as a frontispiece. Because of the conspicuous services rendered to agriculture by Senator Dolliver during his public career, recently terminated by death, the selection will be appreciated by the friends of agriculture throughout the country.

Jos. A. Arnold,
Department Editor.

Washington, D. C., *April 20, 1911.*

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YEARBOOK

OF THE

U. S. DEPARTMENT OF AGRICULTURE.

REPORT OF THE SECRETARY.

Mr. PRESIDENT:

I respectfully present my Fourteenth Annual Report, covering the work of the Department of Agriculture for the year 1910.

AGRICULTURAL PRODUCTION OF 1910.

HIGHEST VALUE EVER REACHED.

PROSPERITY MAINTAINED.

Year after year it has been my privilege to record "another most prosperous year in agriculture." Sometimes the increased prosperity has been due to weather unusually favorable to agriculture, sometimes to higher values caused either by a greater yield or demand, or by greater money returns due to a scant production; but usually the advance in farmers' prosperity has been in spite of various drawbacks. It would seem that this country is so large in extent and has such varied climate, soil, and crops that no nation-wide calamity can befall its farmers. Combined with this strong position in agriculture, the Nation may now begin to derive increased confidence in its agriculture because of improvements that are permeating the whole country in consequence of a grand movement sustained by the National Department of Agriculture and the various state agencies.

VALUE OF ALL PRODUCTS.

Nothing short of omniscience can grasp the value of the farm products of this year. At no time in the world's history has a country produced farm products within one year with a value reaching $8,926,000,000, which is the value of the agricultural products of this country for 1910. This amount is larger than that of 1909 by $305,000,000, an amount of increase over the preceding year which is small for the more recent years.

The value of farm products from 1899 to the present year has been progressive without interruption. If the value of that census year be regarded as 100, the value of the agricultural products of 1900 was 106.4; that of 1901 was 112.7; that of 1902 was 119.1; that of 1903 was 124.8; that of 1904 was 129.8; and that of 1905 was 133. The year 1906 was an extraordinary one for agriculture, both in quantity and in value of production. The value increased to 143.4, as compared with 100 representing 1899. In the next year, 1907, the value of agricultural products rose to 158.7; in the next year, 1908, to 167.3; in 1909 to 182.8; and in 1910 to 189.2, or almost double the value of the crops of the census year eleven years preceding. During this period of unexampled agricultural production, a period of twelve years during which the farmers of this country have steadily advanced in prosperity, in wealth and in economic independence, in intelligence and a knowledge of agriculture, the total value of farm products is $79,000,000,000.

CHIEF CROPS.

In the statement that follows concerning the crop quantities and values for 1910, no figures should be accepted as anticipating the final estimates of this Department to be made later. Only approximations can be adopted, such as could be made by any competent person outside of this Department. All values are for products at the farm, unless otherwise stated, and in no item are values at the produce or commercial exchange.

CORN.

A National asset amounting to 3,000 million bushels, worth 1,500 million dollars, is found in the corn crop. Its production this year was 3,121,381,000 bushels, a crop that exceeds that of even the great agricultural year 1906. It is greater than the average crop of the preceding five years by 14 per cent.

A notable feature of corn production this year is the growing importance of the South. This has been manifested in a small way in very recent years, but now the increased magnitude of the crop in that section, both absolute and relative to National production, forces itself upon the attention.

Let a comparison be made with corn production in the South in the census year 1889, or twenty-one years ago. At that time the South Atlantic States produced only 6.2 per cent of the National crop of corn. This year they produced 9.1 per cent, or an increase relatively of about one-half. The relative increase for the South Central States is even greater, being from 14.8 per cent of the National crop of 1889 to 23.4 per cent in 1910. Then the South produced hardly more than one-fifth of the National crop; now it produces one-third.

The power that this increased corn production gives to southern farmers with respect to independence, release from buying feeding stuffs, in producing meat, and maintaining dairy and other domestic animals is well understood.

While the value of this corn crop is below that of 1909 and also of 1908, its amount belongs to stories of magic. It can hardly be reckoned at less than $1,500,000,000, a sum sufficient to cancel the interest-bearing debt of the United States, buy all of the gold and silver mined in all of the countries of the earth in 1909, and still leave to the farmers a little pocket money.

The corn crop is a National asset in more than one sense. It is not merely wealth in existence for the time being, but it is an asset of perpetual recurrence. Year after year, throughout the ages, a stupendous amount of corn, with incredible value, can be produced.

The cotton crop, including seed, is worth this year only three-fifths of the value of the corn crop; the wheat crop only two-fifths; the hay crop, less than one-half. All of the cereals, except corn, are together worth only three-fourths as much. The great allied iron and steel industries had in the latest census year for which results have been published, 1904, a production worth only 60 per cent of the value of this year's corn crop.

COTTON.

For many years the cotton crop was fourth in value among the crops, being exceeded usually by corn, wheat, and hay. But in those days the price of cotton was very low. The crop of this year may be worth in lint and seed a round $900,000,000 at the farm, or more than the corn crop was worth in any year prior to 1901, or more than the wheat or hay crop was ever worth.

Apparently the cotton crop of this year, including seed, is worth $129,000,000 more than the crop of last year, and that crop was far above any previous one in value. During the last five years the cotton crop had an average value of $685,000,000, so that the value for this year is 13 per cent above the five-year average.

The number of bales in this year's cotton crop will be determined by the Bureau of Statistics of this Department in December, and at the present writing no forecast of that estimate can be suggested. From commercial sources, however, it is evident that the cotton production of this year will be considerably short of being a record breaker, although possibly it may be the fourth in order of magnitude that this country has produced.

The average cotton crop of the preceding five years had a weight which perhaps is not far from most of the commercial estimates for the crop of this year.

HAY.

Wheat has often contended with hay as to precedence in value and the place in 1910 goes to hay, notwithstanding its short crop. The value of the hay crop is about $720,000,000, an amount which has been exceeded but once, and that in 1907, when the crop was worth $744,000,000. Indeed, the value of the crop of this year is much above that of the high crop values of other preceding years, illustrating the principle that a somewhat deficient crop is usually worth more in the aggregate than an abundant one. The value of the crop of this year is 13 per cent above the average of the preceding five years.

The quantity of the hay crop is 60,116,000 tons, and has been exceeded a dozen times. It is 5 per cent below the average crop of the preceding five years. The feeding value of the hay crop, however, is greater than its tonnage implies. Alfalfa has entered into the production of this crop in recent years and has now become in itself a crop of large proportions.

In relative geographic distribution, the hay crop has changed perceptibly during the twenty-one years since the census year 1889. During the interval the North Atlantic States have increased their production of the National crop from 24.3 to 27.8 per cent; the Western division, 7.9 to 16.4 per cent; the South Atlantic, from 3.1 to 3.9 per cent; the South Central, from 3.3 to 5.8 per cent; the two southern groups of States, from 6.4 to 9.7 per cent; and consequently, the North Central States have lost relatively in a marked degree, or from 61.4 to 46.1 per cent of the National crop.

WHEAT.

Fortunately the wheat crop is divided into two sowings, autumn and spring, and consequently it is not improper to regard wheat as having two crops. These to some extent cover the same territory, but they belong largely to different geographic areas, subject to different climatic accidents, with the frequent result that one of the crops is a successful one and the other is not. Such was the fact this year, when the winter crop was a large one and the spring-sown crop suffered from severe drought.

The production of both crops this year is 691,767,000 bushels, or substantially the average of the preceding five years, whereas the value is about $625,000,000, or 7.6 per cent above the five-year average.

The quantity of this year's wheat crop has been exceeded four times, but the value has been exceeded only once, in 1909, although the crop of 1908 was nearly as valuable.

Wheat is another crop that has undergone perceptible change in relative geographic distribution since the census year 1889, but in a less degree than corn and hay. During the twenty-one years the fraction of the National crop produced in the North Atlantic States declined from 6.8 to 5.9 per cent; in the North Central States, from 68.6 to 62.9 per cent; whereas there were increases in the other geographic divisions—from 5.9 to 6.6 per cent in the South Atlantic; from 5.2 to 9.7 in the South Central; and from 13.5 to 14.9 in the Western States.

OATS.

Easily the fifth crop in point of value is oats, a position that it has long occupied. The value this year is probably over $380,000,000, and has been exceeded in this respect only by the crop of 1909. Compared with the average value of the five preceding years, this year's value is 12 per cent greater.

In quantity the crop of this year is a magnificent one. For the second time in the history of this country the crop exceeds one billion bushels, the precise estimate standing at 1,096,396,000 bushels, or about 90 million bushels above the great crop of 1909. The crop of this year is 22 per cent greater than the average of the five previous years.

The production of this crop has shifted somewhat into the South Central and Western States in comparison with the National production since 1889. The share of the North Atlantic States has declined from 10.8 to 8.6 per cent; of the South Atlantic States, from 2.9 to 2 per cent; of the North Central States, from 79.7 to 77.2 per cent; the South Central States gained the difference between 4.7 and 6.5 per cent; the Western States the difference between 1.9 and 5.7 per cent.

POTATOES.

Next in order of value is the potato crop, which was exceeded in only two or three former years. Compared with the average value of the five previous years, the value for this year is 1 per cent greater. With the exception of the crop of 1909, which was in a degree an overproduction, the crop of potatoes this year was the largest ever grown in this country, the preliminary estimate of this Department being 328,787,000 bushels. This quantity is 8 per cent greater than the average for the preceding five years.

SUGAR.

Beet-sugar production in 1910 has been subject to vicissitudes of climate and other influences. A smaller acreage of sugar beets was planted in Colorado; there was a lack of moisture necessary to a full

crop in Utah and Idaho; whereas the production of California, Michigan, Wisconsin, and other States considerably exceeds that of last year, partly due to three new operating factories. Five new factories will be in operation in 1911—two in California and one each in Colorado, Utah, and Nevada. All acreage planted this year returned beets excellent in both quality and quantity.

It is too early now to forecast accurately the production of beet sugar for 1910, but the indication is that the crop will be about as large as that of 1909, or, say, 512,000 short tons. The factory value of this sugar is about $51,000,000, or hardly less than the value of the crop of 1909, which was the record year.

Commercial estimates indicate that the cane-sugar crop of this year will be about 347,000 short tons, which has been frequently exceeded in recent years. The factory value of this sugar is about $28,000,000, an amount that has been exceeded in four years.

If prospects are realized, the entire sugar crop of factory production, beet and cane combined, will be about 859,000 short tons, or a production that has been exceeded in only one year, 1909. In factory value the two sugar crops will equal about $79,000,000, and if to this be added the value of molasses, sirup, beet pulp, and sorghum and maple products, the combined value of the production of sugar, sirup, and molasses, with subsidiary products, is about $97,000,000, or only $4,000,000 under the high-water mark of 1909.

TOBACCO.

The tobacco crop has slightly exceeded the production of the record year 1909, and its 967,150,000 pounds are 26 per cent above the average production of the five preceding years.

Apparently the tobacco prices of 1909 are barely maintained for the crop of this year, and the total value of the crop is therefore about the same as it was for the crop of 1909, or, say, $95,000,000. No tobacco crop previous to 1909 was worth its amount by fully 20 million dollars.

Tobacco, under the better prices of recent years, is steadily climbing upward in production. The average prices for the last five years, including 1910, have been 10 cents a pound and a little better. It seems to be required that the average price of the crop, all types and grades included, shall not decline if this crop is to maintain its increasing production.

BARLEY.

Barley this year has hardly maintained the average production of the preceding five years, the production of this year being 158,138,000 bushels, as compared with the five-year average of 161,240,000.

This year's crop, however, has been exceeded only three times, in 1909, 1908, and 1906.

In point of value the crop of 1910 has been exceeded only in 1907, and the value of this year is 16 per cent above the average of the previous five years.

The price of barley suddenly increased about 60 per cent, to 66.6 cents in 1907, after which it declined to about 55 cents a bushel in 1908 and 1909; but a higher price than this is indicated for the crop of this year.

In relative geographic redistribution of the barley crop since 1889, the share of the North Atlantic States has declined from 12.2 to 2 per cent, while the share of the North Central division of States has increased from 60.3 to 62.8 per cent, and that of the Western States from 26.9 to 34.4 per cent.

FLAXSEED.

Flaxseed follows barley in order of importance of value of crop. At this writing the indication is that the value of the flaxseed production of this year will be about $33,000,000, which would be the record amount were it not for the greater value of the crop of 1909. Compared with the previous five years, the value of this year's crop is 13 per cent greater.

While the value of this year's crop remains near the top, the production is far below that of recent years, the preliminary estimate being 15,050,000 bushels.

The low production and high value of the flaxseed crop are reconciled in the high price of flaxseed per bushel beginning early in this year. The November 1 price at the farm in 1908 was $1.08; in 1909, same month, $1.40; and in 1910, same month, $2.29.

RYE.

Next in order of value is the rye crop, the 32,088,000 bushels being worth at the farm about $23,000,000. This crop is constant in production and varied little in value in recent years. A larger share of the National crop is now produced in the North Atlantic States than in 1889, the increase being from 28.4 to 33.9 per cent. During this time the North Central States have declined in their share from 63.2 to 57 per cent.

RICE.

Rice production in 1910 remains substantially at the figure of 1909, or, say, a little over 1,000,000,000 pounds of rough rice. No year previous to 1909 produced as large a crop; it exceeds the average of the previous five years by 25 per cent.

The price of rice, however, has declined, so that the crop of this year is worth hardly $16,000,000, or about the same as the crops of

1906 and 1907. This value has been exceeded in 1908 and 1909, so that the value of this year's crop is about 2 per cent below the five-year average.

HOPS.

The estimates of persons outside of this Department indicate that the hop crop of this year will be 13 per cent below the average quantity of the preceding five years, and the smallest crop in a dozen years or more. The farm price of hops in 1910 has improved somewhat over the average of the previous five years, so that the total value of the crop of this year is 3 per cent above the five-year average.

ALL CEREALS.

For transportation purposes and as a rough indication of the production of all cereal crops, a statement of the total production of these crops in bushels is interesting. In no previous year has the production of these crops equaled the 5,140,896,000 bushels of the cereals of 1910. The production of this year is 13 per cent above that of the five-year average, which is about 4½ billion bushels.

In value, however, the cereals of this year fall below that of 1908 and 1909, principally on account of the decline in the farm price of corn. This year's value is $2,710,000,000, or about $230,000,000 below the total for 1909 and $50,000,000 below that of 1908; however, it is 11 per cent above the five-year average.

SUMMARY OF COMPARISONS.

This is the year of highest production for corn, oats, the total of all cereals, and for tobacco. But the only crop that reached its highest value this year is cotton.

The list of crops that stand next to the highest, either in quantity or value, or both, is much larger than the foregoing. In production next to the highest year are found for 1910 the crops of rice, hay, beet sugar, and the total for all sugar. In the list of the crops that are next to the highest in value are wheat, oats, barley, tobacco, flaxseed, beet sugar, and the total for all sugar.

The potato crop was third in order of quantity and the corn crop and the total for all cereals were third in value. Barley and rye were fourth in production and potatoes fourth in value. Fifth in production was wheat and fifth in value rice.

The average production of the five years preceding 1910 includes the remarkably productive year 1906 and was generally a period of vigorous production. Notwithstanding the high character of the period, the production of 1910 is above the five-year average in the case of corn, oats, rice, rye, buckwheat, beet sugar, the total for all sugar, potatoes, tobacco, and wool.

In comparison with the average of the preceding five years the value of the crops of this year was greater in the cases of corn, wheat, oats, barley, rye, buckwheat, cotton, beet sugar, the total for all sugar, flaxseed, hay, potatoes, tobacco, and hops.

The value of the farm products of 1910 shows both gains and losses in comparison with 1909. A gain of $130,000,000 is made for cotton lint and seed, $30,000,000 for hay, and $3,000,000 for barley. A loss was suffered in wheat, amounting to $104,000,000; corn, $98,000,000; oats, $26,000,000; potatoes and wool, $23,000,000 each.

The farm value of the cereal crops declined $230,000,000 in 1910 from 1909, and the value of all crops declined $119,000,000. A gain was made, however, in the value of animal products, amounting to $424,000,000. It has been a year of high prices for meat and animals, for poultry and eggs, and for milk and butter, and for these reasons the total value of all farm products increased in 1910 $304,000,000 above the estimate for 1909.

FOREIGN TRADE IN AGRICULTURAL PRODUCTS.

THE TRADE BALANCE.

Until 1898 there was ever a balance of trade against the United States in merchandise other than farm products; in that year for the first time the exports of merchandise other than farm products exceeded in value the imports. From 1898 to 1902 the value of exports of merchandise other than farm products exceeded that of imports, and again from 1904 to 1909. The contrary was true for 1903 and 1910, the adverse balance of the last year for manufactures and other merchandise not produced on the farm being $10,926,193.

On the other hand, in the case of farm products there has been an almost unbroken balance of trade in favor of the United States as far back as inquiry has been made. From 1851 to 1863 is found this favorable balance and also from 1866 to the present time. During the five-year period 1886–1890 the farmer's balance of trade in favor of this country averaged $206,265,002; during the next five years the average was $257,666,800; in the five years that followed the average was $386,637,041; during the period 1901–1905 the average was $431,234,941; and during the last five-year period, 1906–1910, the average was $433,683,775. The increase in this quinquennial average has been unbroken since 1886–1890.

Except for two years, 1898 and 1901, the highest balance of trade in favor of this country in the matter of farm products was $488,004,797 for 1908, a year which seems to mark the culminating point in the course of the balance of trade in farm products. In 1909 the balance declined to $274,210,152, and in 1910 the decline

continued to $198,090,925. It may be that in 1910 there was not that National surplus of agricultural products to export which the country had offered to other nations of the earth in years preceding. But, however this may be, it is a fact recognized in the exporting trade that the prices of farm products in the fiscal year 1910 were high enough to prevent that free export movement which before existed.

In consequence of the favorable balance of trade in farm products, the entire foreign trade of the United States in merchandise has exhibited a surplus of exports over imports almost constantly since 1875.

EXPORTS.

The value of the exports of farm products, after constant oscillation, increased to the enormous amount of $1,017,396,404 in 1908, from which there was a decline in 1909 and another in 1910, for which latter year the amount stands at $871,107,067, a value which has been exceeded only in the years 1901 and 1906 previous to 1907.

In the exports of 1910 the principal item was cotton with a value of $450,447,243. Next in order stands packing-house products with a value of $135,959,373; third in order are grain and grain products valued at $133,320,418; after which are tobacco, $38,115,386; oil and oil-cake meal, $19,251,012; fruits, $18,504,591; live animals, $17,447,735. Compared with 1909, there was a decrease in all of the principal items except in cotton, for which the increase was about $33,000,000, fruits about $2,500,000, and tobacco about $7,000,000.

Farm products as an element of the value of domestic exports have had a decreasing ratio from about 80 per cent at the middle of the nineteenth century to 61.6 per cent in 1900, 55.1 per cent in 1909, and 50.9 per cent in 1910.

IMPORTS.

The imports of farm products have constantly increased in value throughout the history of this country's international trade. They constituted about 25 to 33 per cent of the value of all imports at the middle of the nineteenth century and they increased to 50 per cent and over at the end of that century, since which time they have varied, but have not reached 50 per cent subsequent to 1899. The fraction for 1910 is 44.1 per cent of the value of all imports.

In absolute instead of relative value, however, the imports of farm products have constantly increased until they reached the enormous total of $687,486,188 in 1910, an amount much above that of 1909 and still further above the more prominent amounts of the preceding years.

Among the more prominent imports of agricultural products for 1910 are packing-house products, $130,140,313, mostly hides and skins; sugar and molasses, $107,716,367; coffee, $69,194,353; silk, $67,119,108; wool, $51,220,844; vegetable fibers, $48,234,977; tobacco, $27,756,133; fruits, $24,177,160.

Increases are found, 1910 over 1909, in packing-house products, wool, vegetable fibers, fruits, sugar and molasses, and tobacco.

FOREST PRODUCTS.

The value of the exports of domestic forest products was never so high as in 1910, except for the years 1907 and 1908. In 1910 the value is $85,054,602, and the highest amount ever reached, which was in 1907, was $92,948,705. The value of exported naval stores in 1910 was $18,681,962, a value larger than that of 1909, but smaller than that of other recent years.

The imports of forest products consisted mostly of india rubber, wood pulp, pulp wood, and woods not grown in the United States. Their value in 1910 is $179,610,886, which is by far the highest annual value of imports. It was not until 1907 that the value of these imports exceeded $100,000,000.

PRICES OF FARM PRODUCTS.

FARMER'S SHARE OF CONSUMER'S COST.

AN EQUALIZING PROCESS.

High prices was one of the subjects of my annual report for 1909. It was shown that for many years previous to about 1897, or a little later, the prices of farm products received by farmers were even less than the cost of production, and often little if any above that cost, so that during a long period of years the farmer was not thriving. It was shown also that in the upward price movement, which began about 1897, the prices received by the farmer have advanced in greater degree than those received by nearly all other classes of producers. That this should have been so was merely a matter of justice to the farmer to equalize the reward of his efforts with the rewards received in other lines of production.

INCREASE OF BEEF PRICES.

The price received by the farmer is one thing; the price paid by the consumer is far different. The distribution of farm products from the farm to consumers is elaborately organized, considerably involved and complicated, and burdened with costly features. These are exemplified in my report for 1909 by a statement of the results

of a special investigation into the increased cost of fresh beef between the slaughterer and the consumer.

It was established that in the North Atlantic States the consumer's price of beef was 31.4 per cent higher than the wholesale price received by the great slaughtering houses; 38 per cent higher in the South Atlantic States; and 39.4 per cent higher in the Western States. The average for the United States was 38 per cent.

It was found that the percentage of increase was usually lower in the larger cities than in the smaller ones and higher in the case of beef that is cheap at wholesale than of high-priced beef. It was a safe inference that the poorer people paid nearly twice the gross profit that the more well-to-do people paid.

THE DAIRYMAN GETS ONE-HALF THE MILK PRICE.

Another investigation into the increase of prices in the process of distribution was made in the last week of June, 1910. This time the object was to discover what fraction of the consumer's price was received by the farmer. It was a time of high prices, of high cost of living, and the aim was to ascertain to what extent the farmer received a return out of the high consumer's cost of farm products.

The investigation covered 78 cities scattered throughout the United States, and the information was contributed by a large number of the Department's crop correspondents and by some of its special agents, who made inquiries in all of the 78 cities. The cities were divided into geographical groups for the purpose of computing averages, and these were combined into an average for the United States, all after proper weighting according to importance.

Milk was one of the commodities under investigation—a food product indispensable to a large fraction of the families of the Nation, and now a costly one to all consumers.

While it is true that the dairyman is receiving considerably more for his milk than he did before the present era of high prices, yet it was discovered in this investigation that throughout the United States he receives a scant 50 per cent, or one-half of the price paid by the consumer. The other half goes to the railway company for carriage, to the wholesale milk dealer, if there is one in the chain of distribution, and to the retailer who delivers at the consumer's door.

Freight charges for carrying milk vary according to distance, but their average may be regarded as approximately about 7 per cent of the consumer's price. With the farmer receiving about 50 per cent of that price and the railroads 7 per cent, the remaining 43 per cent of the consumer's price is received mostly by the retailer.

The milk wagon of the retailer has a long route. It stops at a house or two in one city block, perhaps passes several blocks without stopping, and so proceeds to serve customers thinly distributed along a

route of miles. At the same time the milk wagons of other retailers are covering various portions of the same route, and so there is a great waste of effort and of expense in the distribution.

The division of States in which the cost of distributing milk from producer to consumer is the most is the North Central group, in which producers receive 44 per cent of the prices paid by the consumer. Next in order follow the Western States with 47 per cent, the North Atlantic States with 53 per cent, the South Central States with 55 per cent, and the South Atlantic States with 57 per cent.

The average price paid by consumers in the 78 cities is almost exactly 8 cents per quart. In the North Atlantic and North Central States the average is 7.5 cents; in the Western States, 8.9 cents; in the South Central, 9.1 cents; and in the South Atlantic States, 9.3 cents. These prices are for the last week in June, 1910.

BUTTER AND THE RETAILER.

Factory butter was included in this investigation of prices, in the three classes of creamery print, creamery tub, and renovated. Consumer's prices were taken in 78 cities in all parts of the country and the facts were ascertained in the latter part of June, 1910.

In the distribution of creamery butter from factory to consumer the ultimate price includes the railway charge for transportation and the retailer's addition. The freight charge is about 0.6 of 1 per cent of the consumer's price.

As a general average for the 78 cities, the creamery receives 86.3 per cent of the consumer's price for creamery prints. The percentages are nearly the same in all geographic divisions, the lowest, 84.6 per cent, being found in the Western States, and the highest, 87.5 per cent, in the South Atlantic States.

In the case of creamery tub butter, the factories receive 86.5 per cent of the consumer's price in the 78 cities, the Western States again having the lowest percentage, 84.6 per cent. The highest percentage is 88 for the South Central States, and in the other divisions the percentage is between 86 and 87.

Factories that renovate butter receive a somewhat larger percentage of the consumer's price than in the case of creamery prints and tub butter. The average for the 78 cities is 88.3 per cent, with inconsiderable variations among the geographic divisions of the country.

EXHAUSTIVE INVESTIGATIONS.

The increase of price of farm products in their transfer from producer to consumer was thoroughly investigated in all parts of the country and for a large variety of products by the Industrial Commission. Although the facts obtained in that investigation are now about ten years old, it is believed that the ratios between producer's

and consumer's prices are approximately the same now as they were then. At any rate, it seems probable that the farmer is not now receiving a larger share of the consumer's price than he received ten years ago, and he may be receiving a smaller share.

POULTRY.

Within the field of investigation it was found that poultry almost doubled in price between the farmer and the consumer; in other words, the farmer received only 55.1 per cent of the consumer's price. Inquiries were made concerning turkeys as distinct from other poultry, with the result that it was found that the farmers received 63.5 per cent of the final price. Chickens as a separate description are represented by the percentage of 68.4 when priced by the pound, and by 57.1 per cent when priced by the head.

Of the price per dozen paid by the consumer, the producer received 69 per cent in the case of eggs; dried beans, 75 per cent when bought by the bushel; cabbage, 48.1 per cent when bought by the head and 64.9 per cent when bought by the pound; cauliflower, 75 per cent when bought by the dozen; and celery, 60 per cent when bought by the bunch.

THE SMALLER THE RETAIL UNIT, THE LESS THE FARMER RECEIVES.

The general fact was that the producer's percentage of the consumer's price diminished as the quantity sold at retail was smaller. For instance, the apple grower received 55.6 per cent of the consumer's price when the consumer bought by the bushel and 66 per cent when the purchase was by the barrel. When the consumer bought corn by the bushel, the farmer got 70.6 per cent of the price, but when the purchase was by the barrel the farmer received 81 per cent. The strawberry grower received 48.9 per cent of the consumer's price in purchases by the quart and 75.9 per cent in purchases by the crate. A still better illustration is found in the case of onions. In purchasing a peck at a time, the farmer received 27.8 per cent of the retail price; in purchases of a barrel, he received 58.3 per cent; and in purchases by the 100 pounds, he received 69 per cent. So in the case of oranges, when the purchase was by the dozen the grower received 20.3 per cent of the consumer's price, whereas when the purchase was by the box the grower received 59.3 per cent.

FACTS FOR MANY PRODUCTS.

Farmers received 83.3 per cent of the final price in the retail purchase of blackberries by the crate, 75 per cent in the purchase of cucumbers by the third of a bushel, 66.7 per cent in the purchase of egg-plant by the crate, 60 per cent in the purchase of green peas by

the quart, 70.5 per cent when hay was bought by the ton, and 82.2 per cent in the purchase of horses from retailers.

Among the many other products represented in this list are oats, with 73.6 per cent of the price going to the farmer when bought by the bushel; melons, 50 per cent when bought by the pound; parsnips, 60 per cent when bought by the bunch; potatoes, 59.3 per cent when bought by the bushel; string beans, 80 per cent when bought by the barrel; sweet potatoes, 60.8 per cent when bought by the barrel; turnips, 60 per cent in purchases by the bunch; watermelons, 33.5 per cent when bought singly.

In some cases there were purchasers from the farmer who were middlemen. It was found that cotton growers received 93 per cent of the price paid by cotton manufacturers for the raw cotton; 84.1 per cent of the price of broom corn paid by the broom manufacturers; 80 per cent of the price of calves and 91 per cent of the price of cattle paid by packers; 93 per cent of the price of hogs and 74.2 per cent of the price of lambs obtained by packers; 87 per cent of the price of tobacco paid by the hogshead and 92.2 per cent when bought by the pound by manufacturers; 72.9 per cent in the case of wheat bought by millers; and 91.7 per cent in the case of wool bought by manufacturers.

FREIGHT CHARGES.

To the foregoing percentages that represent the share of the farmer in the consumer's price should be added the percentage standing for the freight charge in determining the share of the consumer's price that goes to the middlemen. With approximate accuracy it has been determined that when the farmer received 50 per cent of the consumer's price, the freight charge on butter is about 0.5 of 1 per cent of the consumer's price; eggs, 0.6 of 1 per cent; apples, 6.8 per cent; beans, 2.4 per cent; potatoes, 7.4 per cent; grain of all sorts, 3.8 per cent; hay, 7.9 per cent; cattle and hogs, 1.2 per cent; live poultry, 2.2 per cent; wool, 0.3 of 1 per cent. The foregoing allowances for freight are to be increased by one-half when the farmer receives about three-fourths of the consumer's price.

COFFEE PRICES.

The import statistics of the Department of Commerce and Labor afford some striking comparisons between original value and consumer's price. In the fiscal year 1910 four-fifths of the coffee imported into the United States came from Brazil; 17 per cent from other countries in South and Central America and from Mexico, so that 97.2 per cent of the imports were from Mexico, Central and South America. About 0.1 of 1 per cent of the coffee imports are from Aden and are the nominal Mocha coffee, and 1.3 per cent of the imports are from the East Indies and are the Java coffee.

In 1910 the coffee imported from American countries, which was 97.2 per cent of all coffee imports, had an import value of 7.8 cents per pound. To this should be added the ocean freight rate. From Rio Janeiro the rate is 0.28 of 1 cent, or about one-fourth of a cent per pound. For nearly all of this American coffee the consumers paid prices ranging from 20 to 35 cents per pound. In other words, the import value, plus the ocean freight charge, is only from 23 to 40 per cent of the principal range of prices paid for the coffee at retail.

PRICES PAID FOR TEA.

Tea may be referred to in the same way. In the fiscal year 1910 the average import value of tea was 16 cents per pound. It is assumed that nearly all of the tea consumed in this country is bought at retail prices ranging from 50 to 70 cents per pound and, with this understanding, the import value of tea is from 23 per cent to 32 per cent of what the consumer pays.

CONSUMER'S PRICE AS AN INCREASE OF FARMER'S PRICE.

PRICE GAINS FROM ANOTHER POINT OF VIEW.

In the consideration of this subject so far, the aspect has been that of the producer; the farmer thinks of the price that the consumer pays for farm products and compares with them the price that he himself receives.

While the farmer is looking forward with regard to the prices of his products, the consumer is looking backward, and so regards the prices that he pays as increases upon what the farmer gets. This aspect of the matter may now be worth some attention.

It is established by the investigation of this Department made last June that the milk consumers of 78 cities paid for milk an increase of 100.8 per cent above the price received by dairymen; in other words, the farmer's price was fully doubled. The lowest increase among the geographic divisions was 75.5 per cent in the South Atlantic States and the highest was 111.9 per cent in the Western States.

In the purchase of butter the consumer pays 15.8 per cent above the factory price in the case of creamery prints, 15.6 per cent above in the case of factory tub, and 13.3 per cent above the factory price in the case of renovated butter. The percentages of increase among the five divisions of States do not vary much from the averages for the United States.

Some large percentages of increase of prices were found by the Industrial Commission—135.3 per cent for cabbage bought by the head; 100 per cent for melons bought by the pound, for buttermilk sold by the quart, and for oranges sold by the crate; 260 per cent for onions bought by the peck; 400.4 per cent for oranges bought by the

dozen; 111.1 per cent for strawberries bought by the quart; and 200 per cent for watermelons sold singly.

There were many cases of increase of consumer's price over farmer's price amounting to 75 per cent and over, but under 100 per cent, and among these were 90.5 per cent for apples bought by the barrel and 80.6 per cent for apples bought by the box; 75 per cent for chickens bought by the head; 83.4 per cent for onions bought by the pound; 80.5 per cent for potatoes bought by the bushel; 88.8 per cent for poultry in general bought by the pound; 95.8 per cent for strawberries bought by the box; 82.5 per cent for sweet potatoes bought by the bushel.

It may be worth while to extend the list of farm products that are sold to consumers at a large increase above farm prices. In the class of commodities selling for an increase of price amounting to 50 per cent and over but under 75 per cent above farm prices may be mentioned the following increases: 61.8 per cent for cabbage bought by the pound; 66.7 per cent for celery bought by the bunch, turnips and parsnips bought by the bunch, and green peas bought by the quart; 54.4 per cent for chickens bought by the pound; 50 per cent for eggplants bought by the crate; 68.4 per cent for onions bought by the bushel; 68.7 per cent for oranges bought by the box; 60 per cent for potatoes bought by the peck; 59.8 per cent for turkeys bought by the pound.

The import price of coffee in the fiscal year 1910, which was 8 cents a pound, after the increase to 20 and 35 cents per pound to the retailer, has risen in price to the consumer from 150 to 337.5 per cent. So with tea of the same fiscal year; its import price of 16 cents per pound, after being increased to 50 to 70 cents per pound, cost the consumer an advance of 212.5 to 337.5 per cent.

Before assigning to middlemen the various increases of prices, it is proper to deduct the percentages due to freight rates. The freight charge for milk received in New York is about 18 per cent of the producer's price and in Chicago about 14.7 per cent. Of the import price of coffee, the ocean freight charge from Rio Janeiro is 3.6 per cent. The percentages of farm price for which freight charges stand in the United States may be estimated at approximately 0.9 of 1 per cent of the factory price for butter; 1.2 per cent of the farm price for clover seed; 1.6 per cent for cotton; 1.3 per cent for eggs; 13.6 per cent for apples; 4.8 per cent for beans; 14.8 per cent for potatoes; and 5 per cent for sweet potatoes. The rates for oats, rye, barley, and wheat are nearly the same, ranging from 6 per cent for oats to 7.3 per cent for barley and rye. The rate for corn is 9.2 per cent and the average for all grain is 7.7 per cent. For hay the percentage is 15.8 per cent; for cattle and hogs, 2.5 per cent; for live poultry, 4.5 per cent; and for wool, 0.6 of 1 per cent.

NO GROUND FOR COMPLAINT AGAINST THE FARMER.

From the details that have been presented with regard to the increase of the prices of farm products between farmer and consumer, the conclusion is inevitable that the consumer has no well-grounded complaint against the farmer for the prices that he pays. The farmer supplies the capital for production and takes the risk of his losses; his crops are at the mercy of drought, and flood, and heat, and frost, to say nothing of noxious insects and blighting diseases. He supplies hard, exacting, unremitting labor. A degree and range of information and intelligence are demanded by agriculture which are hardly equaled in any other occupation. Then there is the risk of overproduction and disastrously low prices. From beginning to end the farmer must steer dextrously to escape perils to his profits and indeed to his capital on every hand. At last the products are started on their way to the consumer. The railroad, generally speaking, adds a percentage of increase to the farmer's prices that is not large. After delivery by the railroad the products are stored a short time, are measured into the various retail quantities, more or less small, and the dealers are rid of them as soon as possible. The dealers have risks that are practically small, except credit sales and such risks as grow out of their trying to do an amount of business which is small as compared with their number.

PROBLEM FOR CONSUMERS AND NOT FARMERS TO REMEDY.

After consideration of the elements of the matter, it is plain that the farmer is not getting an exorbitant price for his products, and that the cost of distribution from the time of delivery at destination by the railroad to delivery to the consumer is the feature of the problem of high prices which must present itself to the consumer for treatment.

Why do not consumers buy directly from the farmers? A distribution of farm products in this simple way has already begun in England, where cooperative organizations of farmers are selling by direct consignment to cooperative organizations of consumers in cities.

Farmers' cooperative selling associations are numerous in this country, but cooperative buying associations among the people of cities and towns are few. Aside from buying associations maintained by farmers, hardly any exist in this country. It is apparent, therefore, that the consumer has much to do to work out his own salvation with regard to the prices that he pays. Potatoes were selling last spring in some places where there had been overproduction for 20 cents and in some places for even 9 cents per bushel at the farm, while at the same time city consumers in the East were paying 50 to 75 cents per bushel, although there was nothing to prevent them from combining to buy a carload or more of potatoes directly from the grower and for delivery directly to themselves.

POPULATION, CROP YIELDS, AND PRICES.

PRODUCTION PER ACRE OVERTAKING INCREASE OF PEOPLE.

IMMIGRATION AND BIRTH RATE.

The population of the United States has increased rapidly in the past. Our doors have always stood open to immigrants from other lands. Our ancestors had large families. Our numbers have increased one-third every ten years until 1880, and afterwards one-fourth to one-fifth. Our expanding farm area has easily provided sustenance for our increasing numbers. But with the filling up of our unoccupied spaces some have begun to fear that in the near future we shall be unable to provide all our food from our own fields. Population increases; yields decrease (so it is said), and the time is at hand when we shall have to import foodstuffs; our economic independence will then be gone.

Immigration, however, is not to be counted upon permanently to furnish any considerable annual increase in our numbers. Three-fourths of a million may enter our ports in one year; but the very next year may see a financial depression, with the tide of emigration setting away from our shores. Only the birth rate may be counted upon as a permanent force acting toward increasing the population; and the increase of the native-born population by excess of births over deaths in this country is only about 1¼ per cent a year, with a tendency toward a decreasing birth rate.

The great question, then, is this: Are the products of our agricultural lands increasing or decreasing in quantity? Is the yield per acre of our fields keeping pace with this normal increase of population by births? To the latter question the answer is that the process has begun.

RISING YIELDS PER ACRE.

Dividing the period from 1866 to 1909 into four decades and a succeeding short period of four years, the yield per acre of corn is shown by a study made in the Bureau of Statistics to have declined 2.3 per cent from the first decade to the second, declined 8.2 per cent from the second to the third, increased 7.7 per cent from the third to the fourth, and increased 7.1 per cent from the fourth decade to the succeeding four-year period.

For wheat an even better showing is made, since the figures show a continuous increase in yield per acre, namely, 3.4 per cent from first decade to second, 3.3 from second to third, 6.3 from third to fourth, and 9.6 from fourth decade to final four-year period.

For cotton, the first figure, 2.8, is a decline, but the rest are increases, namely, 2.6, 3.8, and 0.3.

For tobacco, the first figure, 3.4, is an increase, the second, 2.0, is a decline, the third, 5.2, is an increase, and so also is the last, 9.7.

Similar facts are shown for six other leading crops, namely, oats, barley, rye, buckwheat, hay, and potatoes. Not one of the ten crops named declined in yield per acre from the third decade to the fourth, while oats was the only one to show a decline from the fourth decade to the last period of four years. The evidence is very plain that the yields per acre of our crops are now increasing, and if the facts were assembled in detail for the States, it would be found that the percentage of increase in yield in many of them is greater than the percentage of normal increase in population; that is, the increase by births over deaths in the old native element.

Such is the fact with regard to wheat for the fourth decade, as compared with the preceding one, in 26 States, and 2 of the States are all but ready to join them. In 14 States corn production per acre has increased faster than the normal increase of population and this is almost true of 5 more States. The number of States in this list in the case of barley is 21; rye, 30; buckwheat, 19; cotton, 3; potatoes, 24; hay, 35; and more or less States are almost ready to enter this list in the case of all crops.

A demand that is more difficult to fulfill in production per acre is for an increase that equals or exceeds the actual increase of population, including the immigrants and the temporarily high birth rate of the foreign born. But, notwithstanding the fact that this difficulty is greater in the United States than it is in all other countries that have practically ceased to take much new land into cultivation, many of the States of this Nation are each maintaining an increase of production in the case of one or more prominent crops that is greater than the actual increase of population. Ten States are doing this in the case of corn; for wheat the number is 22; for oats, 16; for cotton and tobacco, 1 each; for rye, 21; for potatoes, 15; and for hay, 25.

We can not look for any other result than that the yields per acre of all our crops shall increase at an even faster rate in the future, in view of the intense interest with which our people are turning their attention toward agricultural improvement. If there are certain forces at work which, if unchecked and made more prevalent, will in the future compel us to bid against the world for food, the counteracting forces have nevertheless been already set in motion, with the promise of increasing effect.

INCOME PER ACRE.

The farmer has benefited more than others from the changed conditions which have manifested themselves in increased cost of living. For instance, the product of 1 acre of corn in 1899 was worth on the farm $8.51, but ten years later it was worth $15.20, an increase in

farm value amounting to 78.6 per cent. Similarly, wheat increased in farm value 114 per cent, tobacco 56.2 per cent, and cotton 65.6 per cent. Ten leading crops taken together—including, besides those mentioned, oats, barley, rye, buckwheat, potatoes, and hay—increased 72.7 per cent in farm value.

This, of course, is no advantage to the farmer if the increase in price of the things he has to buy is still greater. To ascertain the facts in this matter, the Bureau of Statistics sent a letter to a large number of retail dealers doing business with farmers. These dealers were asked to quote the prices which prevailed in 1899 and in 1909, taking care to compare articles of the same grades. In this way the percentage of increase in the prices of about 85 articles commonly used by farmers was determined.

In three cases the prices were less in 1909 than in 1899; in four cases they were the same; but in all other cases they had increased, the increases running from 2.7 per cent in the case of manure spreaders and mowers to 53.8 per cent in the case of brooms. Coffee increased 9.8 per cent; flour, 32.4; salt, 14.9; sugar, 8.7; overalls, 22.9; rubber boots, 29; calico, 26.9; muslin, 25; and so on. For all the articles considered the average increase was 12.1 per cent.

Now, compare this with the 72.7 per cent increase in the farm value of the ten leading crops. The farmer has evidently benefited more than the rest of the community—taken all together—from the changes in values.

Put the facts in another way. The produce of 1 acre of corn was equal in value to 1.8 barrels of flour in 1899, but to 2.4 barrels in 1909. Or, it would buy 118.2 yards of muslin in 1899 and 168.9 yards in 1909. The average purchasing power of all crops similarly increased from 2 barrels of flour in 1899 to 2.6 barrels in 1909, and from 132.1 yards of muslin in 1899 to 182.4 yards in 1909. And so with the whole list of articles used by farmers.

The facts may also be put in the form of percentages by letting 100 represent the purchasing power of 1 acre of farm crops in 1899. Then, in 1909 the purchasing power of 1 acre of corn is seen to have increased 90 per cent when spent for coal oil, 32 for coffee, 33 for flour, and 64 for sugar. Now, take the average purchasing power of all crops. It increased 83 per cent when spent for coal oil, 57 for coffee, 30 for flour, 59 for sugar, and so on down the list. Taking the average of all articles, corn increased 60 per cent in purchasing power, wheat 91, and cotton 48, while the grand average increase in purchasing power of all crops is 54 per cent. In other words, the farmer has received a 54 per cent benefit from the changed conditions.

No one can pretend to understand all the forces at work in these matters. Possibly the farmer's present advantage is due, in part,

to temporary conditions of supply and demand that may change to his disadvantage. If it is also due in part to a greater appreciation of the value of the farmer's work, that, too, is something upon which no calculations can be based.

But there is no sort of doubt that a great part of the farmer's prosperity rests upon the bed rock of a greater output, a higher yield per acre. That is to say, farmers and farming have become more efficient, not only to the benefit of the farmer himself, but also to the safeguarding of our National independence. The wisdom of Congress in aiding agriculture in the past, through the Federal Department and the state colleges and experiment stations, as well as the advisability of giving even greater fostering attention in the future to our most fundamental industry, is thus made plainly manifest.

PROPOSED DEPARTMENT OR BUREAU OF PUBLIC HEALTH.

Within the last few years there has been developing a strong sentiment in favor of the Government making larger provision for the promotion and protection of human health, and at the last session of Congress several bills providing for the establishment of a Department or Bureau of Public Health were introduced. Although I am in hearty accord with the general object of providing better facilities for work in the interest of the public health, I find that most of the particular plans which are being urged upon Congress and which are represented by some of the bills referred to would probably have a disastrous effect upon a large part of the important work being carried on by the Department of Agriculture.

The bill which has been most widely indorsed and actively pressed provides for the creation of a new Executive Department to be known as the Department of Public Health, and for the transfer to that Department of "all departments and bureaus belonging to any department, excepting the Department of War and the Department of the Navy, affecting the medical, surgical, biological, or sanitary service, or any questions relative thereto," and for the transfer specifically of the Bureaus of Entomology, Chemistry, and Animal Industry of the Department of Agriculture. The effect of the language above quoted, if fully carried out, would be to transfer the Department's biological work relating to plant life, such as is carried on by the Bureau of Plant Industry and the Forest Service. Other bills introduced in Congress provide for a Bureau of Public Health and for the transfer to that Bureau of only certain portions of the work above mentioned.

It can readily be seen that the effect of the bill first mentioned, which is being seriously pressed upon the attention of Congress, would be to disintegrate the Department of Agriculture and to take

away from it work which it properly performs and which clearly has no logical place in a Department or Bureau of Public Health. Even though some of the more unreasonable features should be dropped, it is seriously proposed to place in the Department or Bureau of Public Health the work relating to the enforcement of the Food and Drugs Act now carried on by the Bureau of Chemistry, and the meat inspection and veterinary service of the Bureau of Animal Industry.

To remove from the Department of Agriculture the meat-inspection and veterinary work would, I believe, be a great detriment to the work of this Department and to the agricultural and live-stock interests, without any corresponding gain in efficiency or advantage to the public, and would result in increased expenditures rather than in economy.

The most important function of the Department of Agriculture is to study means for providing a sufficient and wholesome supply of food for the people of the country. With the rapidly growing population, without any corresponding increase in the area of land, and with the increasing prices of the necessaries of life, it becomes more essential that the Department should aid in the development and introduction of methods of agriculture which will increase and conserve the supply of food. This work relates not only to the production of field corps but to the breeding and raising of animals. The production of meat and dairy animals involves not only problems of breeding, feeding, and handling, but also those of studying, preventing, curing, and eradicating animal diseases. It would be utterly impracticable to separate the work relating to diseases from that relating strictly to animal husbandry. These various subjects are parts of a single great problem which is primarily agricultural, notwithstanding its relation to human health.

With regard to the meat inspection, experience in this and other countries has shown that this work can best be done by and under the direction of veterinarians. In the work of the Department of Agriculture it has been found that some of the same men can be utilized at different seasons of the year in meat inspection and also in other work. For example, the field work for the eradication of diseases of animals is carried on mostly during the summer, while the work of slaughterhouses is heaviest during the winter; and it is thus found to be practicable and economical to shift men from one to another of these branches as the needs of the service require.

If any of these lines of work were transferred from the Department of Agriculture to the proposed Department or Bureau of Public Health, the work of the former Department would be seriously crippled, and in order for this Department to continue its work efficiently it would have to replace a large part of the organization so transferred.

This would inevitably result in a duplication of work and expenditure, instead of the supposed economy which is one of the arguments given in favor of such a transfer.

I can not see that it is at all essential to an efficient public health organization that there should be included in such organization work which more properly belongs in the Department of Agriculture, or that the Department of Agriculture should be disintegrated in the manner proposed. There seems to be an ample field for public health activities without encroaching upon the field of agriculture and without taking away work which is already being satisfactorily performed by the Department of Agriculture, and which, in my judgment, it can perform better and more economically than any other agency.

ENFORCEMENT OF THE FOOD AND DRUGS ACT.

The Food and Drugs Act operates in two ways: First, it deals with food and drugs which are shipped into interstate commerce or which are manufactured or offered for sale in the District of Columbia or the Territories; second, it prevents adulterated and misbranded foods and drugs from entering the country.

During the fiscal year 1910, 990 interstate cases based upon the Food and Drugs Act of June 30, 1906, were reported to the Attorney-General, 766 cases as the basis for criminal action, and 224 cases as the basis for seizure proceedings. Of the 766 criminal cases, 246 resulted in convictions. Verdicts for the defendants were rendered in 3 cases; 96 cases were dismissed on the recommendation or with the concurrence of the Attorney-General or the United States attorney in charge; 152 cases were pending in the courts at the close of the year, while 252 cases remained in the hands of the Attorney-General or the United States attorneys for consideration and presentation to the courts. In no case was leniency shown in cases involving foods unfit for consumption or deleterious to health, or involving drugs containing dangerous and habit-forming ingredients. Fines were collected in the sum of $7,858 in cases reported during the year. In addition, 60 criminal cases reported in previous years terminated, fines being assessed in the sum of $2,701.31, making the total of fines collected under this act during the year $11,049.31. Of the 224 seizures of adulterated and misbranded foods and drugs, 132 resulted in decrees of condemnation and forfeiture, while 50 cases were pending at the close of the year. In addition, 43 shipments were forfeited under seizures effected during the previous fiscal years.

Twenty-one of the ports of entry in the United States are provided with well-equipped laboratories, and during the past year there has been great activity in examining foods and drugs to prevent any misbranded or adulterated ones from being put on the American market. During the past year 95,482 samples were examined. Of this number.

approximately 3,000 were found to be illegal and were either altogether refused admittance to the country or else admitted only after they had been properly branded or the objectionable features removed or obliterated. Of the grand total above given, 5,130 samples were submitted to careful examination in the laboratory, the remainder to inspection as the products were opened by the appraisers for the assessment of duties.

That the result of this inspection at the ports has resulted in an improved quality in many instances is shown, for example, by the change in the character of the fig imports now offered for entry. In the report for last year attention was directed to this article of food. The figs now offered for the use of the people are cleaner and better than they were last year.

Several years ago a great many detentions were made at the port of New York of lemon oil sophisticated with pinene. The character of the oil offered for entry during the past year has been practically free from all objectionable features. Very few cases are met with now where objectionable preservatives have been used. The coloring matter used in foods is practically confined to the list of aniline dyes mentioned in Food Inspection Decision 76.

WORK OF THE DEPARTMENT IN 1910.

OFFICE OF THE SOLICITOR.

Since June 30, 1909, the work of this Office has more than doubled. There were reported to the Attorney-General in the past fiscal year, through this Office, in all, 1,738 cases arising under the acts of Congress administered by the Department of Agriculture, being twice as many cases as were similarly reported in the fiscal year 1909. As a result of these reports between $40,000 and $50,000 in fines and costs was assessed against defendants; hundreds of tons of adulterated or misbranded foods and drugs were forfeited, and many cases of claims to lands lying within the National Forests were adjudicated. In addition a large number of permits for the use of the resources of the National Forests were scrutinized; 350 contracts, leases, and bonds were prepared, and the sufficiency of the execution of the same later examined; letters patent on inventions made by the employees of the Department and for dedication to the public were secured; the entire Office, both in the field and in Washington, was reorganized, and the force in Washington assembled under one roof. Nearly 100 written opinions were rendered to the Secretary and the various chiefs of Bureaus on the interpretation of the acts of Congress applicable to the Department, or on legal questions arising in the conduct of the business of this Department; close touch was kept with all the Department's cases in the hands of United States

attorneys, memoranda as a basis for briefs were prepared for their use, and, in general, the cooperation between the officers of the Department of Justice and this Office was complete and cordial. The cases arising under the acts of Congress administered by the Department of Agriculture are extremely varied in character; they include criminal actions for trespasses on National Forests, prosecutions of manufacturers and dealers who ship or sell adulterated and misbranded foods or drugs, prosecutions of persons who ship uninspected meats in interstate commerce, prosecutions against railroad companies for transporting live stock out of areas quarantined for disease, actions against carriers for detaining live stock without feed, water, or rest in transit for more than twenty-eight hours, prosecutions for the interstate shipment of game killed in violation of state game laws, civil actions for the seizure of adulterated or misbranded foods and drugs, and suits for damages for injuries to the National Forests.

Important decisions upon questions arising in such cases have been handed down by the United States district and circuit courts and circuit courts of appeals. At the close of the fiscal year 1910 five cases in which this Department is directly interested were on the docket of the Supreme Court of the United States. Many of these cases have attracted considerable attention throughout the country, notably United States *v.* Grimaud, involving the validity and effect of the regulations made by the Secretary of Agriculture regarding the National Forests; United States *v.* Baltimore & Ohio Southwestern Railroad Company, involving the unit of violation under the Twenty-eight Hour Law; United States *v.* Johnson, involving the question whether the Food and Drugs Act applies to alleged false claims as to curative properties of proprietary medicines, and United States *v.* Pittsburg Melting Company, involving the constitutionality of the Meat-Inspection Law.

The agricultural appropriation act of May 26, 1910, contains the following provision: "Hereafter the legal work of the Department of Agriculture shall be performed under the supervision and direction of the Solicitor." This was, in effect, simply a recognition by Congress of the position of the Solicitor since the office was created, on June 17, 1905, by General Order No. 85, as legal adviser to the Secretary of Agriculture. Pursuant to this provision, General Order No. 140 was issued, effective July 1, 1910, supplementing General Orders Nos. 85 and 138, and outlining the work to be performed by the Solicitor on behalf of the various Bureaus, Offices, and Divisions of this Department. By Genera Order No. 138 the legal work of the Forest Service was placed under the immediate supervision of the Solicitor; theretofore, while handled in general under his direction, this work was in the immediate charge of the law officer of the Forest Service. That office has now been abolished.

Since January 15, 1910, therefore, the law work of the Forest Service has been under the immediate direction of the Solicitor. Since that date 105 cases of apparent violations of the acts passed for the protection of National Forests were reported to the Attorney-General for appropriate action; 51 written opinions were rendered to officers of the Forest Service on the legal phases of questions arising in the administration of the National Forests; 53 agreements, 150 leases, and 47 bonds were prepared during the same period on behalf of the Forest Service; 565 cases of contested claims to lands within the National Forests initiated under the public land laws, including the homestead and mining laws, were disposed of during the same period by the branches of this Office in the field.

Under the Twenty-eight Hour Law 438 cases were reported to the Attorney-General; in the 139 cases closed during the fiscal year 1910 penalties aggregating $16,500 were recovered, and costs to the amount of $2,919.35 were paid; 19 cases out of 158 tried resulted in favor of the defendants; 29 cases were dismissed for insufficiency of evidence; 559 cases were pending at the close of the year. Experience in the administration of the Twenty-eight Hour Law during the past year does not disclose any considerable improvement in the methods of handling live stock in transit, since more than twice as many instances of apparent violations of this statute were reported as during the preceding year. To carry out the present intent of Congress in passing the act, which was framed to secure the humane handling of live stock in transit, it would seem that an additional provision should be incorporated therein requiring carriers to maintain a reasonable minimum speed on all stock trains. One hundred and forty-eight apparent violations of the live-stock quarantine laws were reported to the Attorney-General during the year; fines in the sum of $2,970 were collected in the 20 cases disposed of during the fiscal year 1910. Fifty-two violations of the Meat-Inspection Law of June 30, 1906, were reported to the Attorney-General during the year; of these, 18 resulted in conviction, 8 were dismissed because of the insufficiency of the evidence, and 26 are pending in the courts. Two cases were reported to the Attorney-General under the Lacey Act regarding the interstate transportation of game killed in violation of state laws. One case is pending and the other was abandoned because of the apparent impossibility of proving the interstate shipment. Four cases coming over from the previous year were disposed of; in two the grand jury failed to return an indictment; in the other two cases fines were assessed.

An important decision was handed down by the Circuit Court of Appeals of the Eighth Circuit toward the close of the year, sustaining the constitutionality of the Lacey Act and the power of Congress to require that interstate shipments of game be plainly marked so as to show their contents. A detailed statement of all the cases

reported or tried under the various acts of Congress administered by this Department, together with a full description of the work of this Office during the past fiscal year, will be found in the report of the Solicitor.

The work of the Office of the Solicitor in connection with the Food and Drugs Act is discussed under the heading "Enforcement of the Food and Drugs Act."

CHANGES IN THE PERSONNEL.

The total force of officers and employees on the rolls of the Department July 1, 1910, as shown by the report of the Appointment Clerk, numbered 12,480, an increase of 1,340 for the fiscal year. The force employed in Washington numbered 2,414 and 10,066 were employed outside of Washington. During the year 34,267 appointments of every description were made, including 22,622 persons appointed in the forests and fields and on stations in the various States in the manual-labor grades for very short periods, generally three months, or in other grades for six months or less. The number of persons receiving probationary appointments, equivalent to absolute appointment if retained in the service after the probationary period, was 1,088. There were reinstated 56, and transferred from other Departments 67. During the year there were 681 resignations from the service, 61 died while in the service of the Department, and 75 were dismissed for the good of the service because of their misconduct. On July 1, 1910, there were 1,420 officers and employees on the statutory roll (positions specially provided for by Act of Congress making appropriations for the Department), and 11,060 were paid from lump-sum appropriations. The large number of emergency appointments is made necessary by the varied experiments, demonstrations, meat and food inspection, work on the National Forests, extinction of injurious insects, etc., where temporary help is required, some of which was employed on July 1, 1910, making the apparent increase in the Department's employees greater than the actual.

WEATHER BUREAU.

The operations of the Weather Bureau during the past year have been marked by an enlargement of its service to the general public. There has been a normal increase in the volume of its routine business, while, at the same time, the prosecution of its work along lines of scientific research has made encouraging progress. There has also been increased activity in special investigations of the relations of meteorology and climatology to the flow of water in streams, to irrigation and reclamation projects, and to problems of forest and plant growth, all of which are at present engaging the attention of the country to an unusual extent, especially in portions of the West.

RESEARCH WORK.

The exploration of the upper atmosphere by means of kites and balloons has been continued at the Mount Weather Research Observatory, with satisfactory results. There were only nine days during the year on which ascents were impracticable. The record of heights reached shows that the majority of flights did not reach above 10,000 to 13,000 feet, only about 17 per cent of the total number exceeding that elevation. On days when kites and captive balloons can not be sent up, on account of unfavorable weather conditions, small balloons are liberated, either singly or in tandem. Their first simultaneous use in this country was made by members of the Mount Weather Observatory in September and October, 1909, field parties having gone to Fort Omaha, Nebr., and Indianapolis, Ind., for that purpose, while a second expedition continued the experiments at Fort Omaha in May, 1910. Of the instruments sent up in these small balloons, 12 out of 13 sent up from Fort Omaha and 6 out of 7 sent up from Indianapolis were recovered after the first trip, while 15 out of 20 were secured after the second trip.

The main difficulty met with in attempting to make satisfactory scientific deductions from the flights is due to the varying heights reached and to the differing weather conditions under which they are made, it being obvious that a direct comparison of atmospheric conditions, one day with another, is not possible, unless daily records are obtained from approximately the same levels. Notwithstanding this the work of aerial research has already disclosed a number of new and important facts, of which the following may be enumerated:

It has been found, for example, that the stratification of the atmosphere as regards temperature and moisture is far more extensive than was suspected. The accepted rule of decrease in temperature with increase in altitude has many exceptions, a great layer of warm air being frequently found floating upon a layer of cold air, while the thickness and horizontal extent of such warm masses have been found to vary greatly. Again, temperature inversions have been recorded by instruments at the time of ascent, whereas no trace remains when the kite is brought down again a few hours later. Likewise the depth of a given air mass changes with its onward movement past the line of ascent and the wind direction varies with different levels; sometimes when the surface wind is from the south, the direction half a mile upward may at the same moment be from the southwest and half a mile above that level it may be from the west. Cloud movements indicate that in this hemisphere the wind direction changes to the right with increasing altitude, but kite and balloon observations show that it is also deflected to the left at times. It has also been found that the depth of easterly winds is much less on this con-

tinent than over Europe. The observations also seem to show that temperature changes at the surface of the earth and at altitudes of 1 to 2 miles occur simultaneously, thus contradicting previous statements that the changes at relatively high levels foreshadow those for low levels twenty-four hours later. It has further developed that the temperature gradients for heat thunderstorms do not accord with those called for by theory. Similarly in hot waves the unusually high temperatures appear to be confined to the strata within half a mile of the earth's surface, while the heat wave does not advance abruptly with a solid front like a wall, but is built up gradually over the affected region.

Studies of atmospheric electricity and magnetism have been continued along the lines heretofore pursued, while the measurements of the intensity of solar radiation and the percentage of polarization of sky light have been made at Mount Weather and Washington as in previous years. The solar radiation records during the five years of observation show marked departures from the monthly and annual mean rates, just as similar records at European observatories during the past twenty-six years also show marked fluctuations in this respect. This study will be further pursued during the coming year at four or five additional stations, so located as to be fairly representative of the different climatological sections of the country.

Progress has been made toward installing apparatus for the study of the quantity of vapor in the atmosphere, and the investigation of the properties of different bodies as radiators and as absorbers of radiation. The question of the quantity of water vapor in the atmosphere is of sufficient importance to justify attempts to determine it, although the amount next the earth's surface is so strongly affected by purely local conditions that its consideration in weather forecasting has long since been abandoned.

Articles discussing the theoretical as well as the practical application of the data obtained at Mount Weather and other points appeared in the quarterly bulletin of the Observatory during the year. While devoted principally to the work at the Observatory, the columns of the bulletin are open to contributions from scientists engaged in corresponding lines of research anywhere in the world.

FORECASTS AND WARNINGS.

The application of the Mount Weather investigations to practical forecasting at Washington continued during the year, and has proved of material aid in increasing the accuracy and range of the forecasts. A few examples of possibilities in this way will serve to illustrate:

Sometimes a storm passes eastward without being followed by expected clearing weather, because a second storm was developing off the middle or south Atlantic coast. This new development is not

indicated by surface observations, but the Mount Weather flights show north winds at high altitudes in advance of such formation. Again, when an atmospheric depression is approaching from the southwest, and the kite records show winds turning to the right with ascent, the usual warming up in the Atlantic States is retarded about twenty-four hours. Likewise, the turning of the winds to the left with ascent shows the depth of the cold northwest wind, from which inferences may be drawn as to the probable fall in temperature at the surface of the earth within the ensuing twenty-four hours. The thickness of the advancing stratum from the west or northwest also furnishes a clue to subsequent temperatures; when shallow, the cold is neither severe nor prolonged; but when the stratum is thick, and abnormally low temperatures are reported aloft, the cold will be of marked intensity and will prevail several days.

The hurricane season of the year was marked by a number of severe tropical disturbances, but in every instance warnings to shipping and other interests were given sufficiently in advance to enable them to take all necessary precautions. These storms comprise the Galveston hurricane of July 21, 1909, the hurricane that struck the coast near the mouth of the Rio Grande on August 27, 1909, the tropical storm that reached the Louisiana coast on September 21, 1909, and the Key West hurricane of October 11, 1909. That none was attended by loss of life is freely attributed by the press and public to the ample advance warnings of the Bureau. A somewhat extended account of the Key West hurricane appeared in my last report, in which it was shown that the special efforts of the Bureau were successfully directed to warning workmen engaged in the extension of the Florida East Coast Railroad, and that about 3,000 employees were withdrawn from dangerous points as a result of timely advices.

The cooperation of steamship lines has been requested during the coming year as an aid to the forecaster in predicting the direction of movement and the intensity of hurricanes in southern waters, through the receipt of wireless reports from vessels that may encounter conditions indicating the presence of a hurricane in their neighborhood. A circular was also issued to storm-warning distributing centers on the Atlantic and Gulf coasts, having for its object a revival of interest in the Bureau's system of furnishing hurricane warnings to people living in districts where unusually high tides would likely cause loss of life and property.

Forecasts for extended periods were made from time to time, as justified by general weather conditions, and since the latter part of March, 1910, regular weekly forecasts for the United States, together with a general résumé of the weather for the northern hemisphere, have been issued. Gratifying success has been experienced in the verification of these forecasts, especially when they betokened the

breaking up of continued drought or the approach of cold waves or heavy snows.

The distribution of the information contained in the Bureau's forecasts and warnings has been effected, as in previous years, by telephone, telegraph, and mail, and through the press. The requests for additional weather reports by telegraph from the various observing stations were unusually numerous, exceeding those for any single year in the previous history of the Bureau. While public requirements in this respect have been met as far as possible by a reorganization of the Bureau's system of "circuit" reports, the demands were more than could be satisfied with the present fund available for telegraphic expenses.

RIVERS AND FLOODS.

The great floods of the year were those in the Missouri and its tributaries east of Kansas City, and in the Mississippi from Hannibal, Mo., to Chester, Ill., in July; in the North Pacific States in November and December; and in Utah and southern California in January, the last being one of those rare occurrences known as a "desert flood." The total loss was about $14,000,000, all of which was unavoidable. During the July floods about 1,000,000 acres of farm land, two-thirds of which was under cultivation, were overflowed, and the crop loss alone amounted to $5,500,000. The warnings issued during this flood saved property to the value of $1,000,000.

An extension of the river service has been made in the watershed of the Saginaw River, in Michigan, during the year. The river district of Hannibal, Mo., was also created, by assigning to it that portion of the St. Louis district between Hannibal and the mouth of Des Moines River. There is need of further extension of direct flood work, but other projects during the coming year will consume all available funds. The study of the Ohio River was continued, while schemes for the Cumberland and Tennessee rivers are well advanced. It is hoped that the entire scheme for the Ohio watershed will be completed during the coming year.

It was recognized more than a year ago that the approaching completion of irrigation projects in the far West had imposed new responsibilities on the Weather Bureau in the way of obtaining accurate snowfall measurements at the sources of water supply, the determination of the water equivalent of the accumulated snows of winter, and the gauging of the streams for the benefit of the water users. The prosecution of these inquiries has been intrusted to the River and Flood Division, and a series of observations along definite lines has already been planned.

EVAPORATION STUDIES.

Studies of evaporation were continued at the Salton Sea, and a summary of the observations is being prepared. The problem of

the rate of evaporation has been a difficult one to solve. The rates differ greatly for different points on or near the water and under different conditions of wind movement and elevation. The records of the Geological Survey show that the sea has been falling at the rate of about 55 inches annually for the past three years. The coefficients of evaporation deduced by the Weather Bureau from its experiments indicate an annual evaporation from the surface of about 70 inches. As the annual water inflow is thought to be about 15 inches, it will be seen that the results arrived at experimentally by the Bureau are in close accord with the observed general facts at that point, and, furthermore, that the coefficients established will probably be equally applicable to conditions of evaporation anywhere.

NEW APPARATUS.

Observations were made during the winter of 1909–10 with various forms of snow gauges suited for installation in the mountain districts of the West, whereby an accurate catch could be obtained and also be preserved for measurement at extended intervals. Further experiments will doubtless soon develop the best form of apparatus. New methods of measuring the intensity of solar radiation in absolute units of heat, by the use of the electrical resistance thermometer, were perfected during the year, and detailed drawings of a seismograph adapted to record very destructive earthquakes was supplied to the University of California by the Bureau.

It appears proper at this point to renew a former recommendation that Congress be requested to authorize and provide for seismological work, and to place it under the control of the Weather Bureau, which is already prepared through its widely distributed corps of regular and cooperative observers to collect and study earthquake observations. That the Bureau is prepared to conduct this work in an effective manner and at far less expense than any other department of the Government has already been recognized by the Seismological Committee of the American Association for the Advancement of Science, which, at its meeting in Washington in 1907, voted that the Federal Government be requested to support seismological work, and that the appropriations therefor be made through the Weather Bureau.

MARINE WORK.

The Marine Division continued to prepare and publish pilot and meteorological charts for the oceans, and will shortly begin the issue of a meteorological chart for the Great Lakes. A duplicate of the information collected by the Weather Bureau from cooperating vessels is furnished to the Hydrographic Office of the Navy Department, the information thus furnished constituting an important part of the Pilot Chart published by that Office. The Marine Division

also has charge of the wireless telegraph and vessel-reporting services of the Bureau; these services have been conducted to the satisfaction of marine exchanges and other similar associations during the year.

PUBLICATIONS.

Certain changes in the manner of issuing publications were made during the year with a view to better serving the public needs. Of these, the most important was the policy adopted of discontinuing station weather maps wherever the newspapers would undertake their publication. Although the plan has been operative only four months, the "commercial weather map," as it is called, is now being published in 65 morning and evening papers in 45 cities, while 55 additional stations will introduce the method as soon as suitable outfits can be supplied. As a result of the change, the weather chart is now placed twice daily before millions of people, instead of thousands as heretofore, while the saving to the Bureau by discontinuing printing work will enable extensions of service along other lines.

BUREAU OF ANIMAL INDUSTRY.

The Bureau of Animal Industry has charge of the work of the Department relating to the live-stock industry. It conducts the inspection of live stock, meat, and meat food products intended for interstate or foreign commerce, under the act of Congress of June 30, 1906, and also has charge of the inspection of import and export animals and the quarantine stations for imported animals. It makes investigations in the breeding and feeding of live stock and in regard to the dairy industry. It also carries on scientific investigations as to the nature, cause, and prevention of communicable diseases of live stock and takes measures for their control and eradication, frequently in cooperation with state and territorial authorities.

MEAT INSPECTION.

The meat inspection has reached such proportions that it is only by strict economy that the Department is able to carry on this work within the standing annual appropriation of $3,000,000. During the past fiscal year the cost of this inspection was about $2,940,000. The inspection was conducted at 919 establishments in 237 cities and towns, an increase of 43 establishments and a decrease of 3 cities and towns as compared with the preceding year. There were inspected before slaughter 49,307,672 animals, consisting of 7,999,547 cattle, 2,295,800 calves, 27,731,627 hogs, 11,164,635 sheep, and 116,063 goats. The animals inspected at the time of and after slaughter numbered 49,179,057, of which 7,962,189 were cattle, 2,295,099 calves, 27,656,021 hogs, 11,149,937 sheep, and 115,811 goats. Owing to a marked shortage in the supply of hogs there was a decrease of nearly 8,000,000 in the number slaughtered under inspection as com-

pared with the previous fiscal year, although there was an increase in the number of all other species.

There were condemned because of disease or other condition 113,742 entire carcasses and 874,211 parts of carcasses, making a total of nearly 1,000,000 animals condemned in whole or in part, or about 2 per cent of the total number inspected. Tuberculosis was the cause of over 46 per cent of the condemnations among cattle and over 96 per cent of those among hogs.

Nearly six and a quarter billion pounds of meat food products of various kinds were prepared under the supervision of the government inspectors, and there were condemned on reinspection over 19,000,000 pounds of these products which had become unwholesome since inspection at the time of slaughter. The steady decrease in condemnations of this class indicates a corresponding improvement in sanitary conditions and in the methods of handling meat products in the packing houses.

The Department continues to maintain the closest vigilance over its meat-inspection service in order to guard against inefficiency or corruption on the part of any of the members of its force and against fraudulent practices on the part of the management of the inspected establishments. It is gratifying that, so far as known, there have been no serious shortcomings during the past year. Not only does the Department force show a high degree of integrity and efficiency, but the proprietors of the inspected establishments as a rule are entirely disposed to comply with the regulations and give cordial cooperation in the work of inspection. The regulations are based upon long experience and upon the best scientific knowledge not only of the Department staff but of outside experts, and an honest effort is made to enforce these regulations. It can be said without question that Government inspected meat merits the full confidence of the public.

The greatest source of danger with regard to the meat supply of the country comes from the meat which is not subject to inspection. The Government inspection is applied only to such meats as are produced by persons or establishments doing interstate or export business, and covers but a little more than half of the country's meat supply. The remainder must be looked after by state and municipal authorities, and it is gratifying that there is a general awakening to the need for local inspection. Inspection is already being carried on by many cities and a few States, and in other places steps are being taken to establish an efficient inspection system. The Department stands ready to give such aid and cooperation as it properly can.

ANIMAL HUSBANDRY.

In recognition of the growing importance of the work carried on by the Bureau of Animal Industry in the breeding and feeding of live

stock the Animal Husbandry Office of that Bureau was designated as the Animal Husbandry Division, beginning with January 1, 1910.

Some promising animals are being obtained in the breeding experiments with carriage horses in Colorado and Morgan horses in Vermont. The wisdom of the purchases previously made of breeding animals has been demonstrated, and some additional purchases were made during the year. The young stock is passed on at intervals by a board of survey to determine what animals should be retained for the breeding experiments and what should be disposed of. At the close of the fiscal year there were 71 animals in the Colorado stud and 30 in the Vermont stud. Experiments in breeding range sheep in Wyoming are being continued with the object of improving the quality and type of this class of sheep. Good results are being obtained in experiments in breeding Holstein cattle in North Dakota and in developing a milking strain of Shorthorn cattle in Minnesota.

In the breeding experiments at the Bureau's experiment station at Bethesda, Md., several additional zebra-ass hybrids have been obtained. These are beautiful clean-limbed animals, and those now in their second year are considerably larger than their dams, although not as large as their sire. Extensive experiments in the breeding of small animals for the purpose of studying inbreeding, heredity, and similar problems have been continued.

Investigations in beef production in Alabama which have been in progress for six years indicate that with the eradication of the cattle ticks this may be made a profitable business in the South, and that in future the South may become the source of an important part of the beef supply of the country. The profits in feeding several experimental lots of steers ranged from $6.99 to $10.64 per head.

POULTRY AND EGG INVESTIGATIONS.

The cooperative experiments in poultry breeding and selection at the Maine Agricultural Experiment Station are yielding results which have an important bearing not only upon the breeding and selection of fowls for egg production but also upon the broader problems of breeding animals for production in general. The poultry-feeding experiments at the Bureau's experiment station have been seriously interfered with by the reappearance of coccidiosis, or white diarrhea, in the flock. Feeding experiments with cottonseed meal indicate that 30 per cent of this material is as high a proportion of the ration as the fowls will eat readily, but no harmful effects from this feed have been observed. Cowpeas, soy beans, and dried beet pulp have also been used experimentally as poultry feed with satisfactory results.

Work for improvement in the methods of handling eggs has been undertaken, and while it has not progressed very far it is certain

that better methods will bring about a great reduction in the heavy losses experienced in the egg trade.

BREEDING HORSES FOR ARMY USE.

For some years the United States Army has found great difficulty in obtaining a sufficient supply of horses of a suitable character, and this condition led the Secretary of War during the past fiscal year to invite my cooperation in working out some plan for meeting the difficulty. A representative of this Department was accordingly designated to confer with the representative of the War Department, and these gentlemen have submitted reports pointing out the necessity for Government encouragement of breeding army horses and outlining a definite plan with an estimate of the cost. It appears that on the present peace footing the mounted service of the Army requires from 2,000 to 2,500 horses a year, and in order to supply this number of suitable animals it is estimated that at least 100 stallions would be required. These stallions should be purchased and owned by the Government, and arrangements should be made for the use of privately owned mares of suitable type and breed, the War Department to have an option on the purchase of the foals. It is estimated that the cost of putting such a plan into execution would be $250,000 for the first year for the part of the work to be administered by the Department of Agriculture, and that the annual expense of maintaining this work thereafter would be about $100,000. It seems essential that the Government should undertake some plan of breeding suitable horses if the efficiency of the mounted service of the cavalry and artillery branches of the Army is to be maintained, and such a plan would also have experimental possibilities of high value to the horse-breeding industry.

WORK RELATING TO THE DAIRY INDUSTRY.

DAIRY FARMING INVESTIGATIONS.

The average production of dairy cows in the United States is entirely too low, and there is no doubt that it can be raised considerably by proper methods. It is important that the dairyman should know which of his cows are good producers and which are kept at a loss, so that the latter may be eliminated and the herd built up with profitable cows. The best known method of doing this is by keeping records showing for each animal as closely as possible the cost of maintenance and the yield of milk and butterfat. Purebred bulls should be used for the improvement of the dairy herd. Work in this direction is being actively carried on by the Dairy Division of the Bureau of Animal Industry in cooperation with state authorities, dairy associations, and other agencies in the South and West. Besides assisting the farmers in keeping records and introducing purebred sires, the Department furnishes plans for dairy barns, silos, dairy houses,

etc., gives advice as to the erection of these buildings, and assists in the organization of dairy and live-stock associations.

Cow-testing associations are an effective means for improving dairy herds and increasing their yield, and the Department has two men engaged in giving assistance in organizing and conducting these associations. This work is done always in cooperation with state officials or some state or local institution. Twenty-eight new associations were formed during the past fiscal year, making a total of 55 now in operation in the United States. As an example of the value of the work done by these associations, the records of one of them show that in four years the average annual profit on each cow has been practically doubled, having been raised from $21.43 to $42.82, while the average return for each dollar expended in feed has been increased from $1.64 to $1.98.

IMPROVEMENT OF CREAMERY BUTTER.

The Bureau of Animal Industry has continued the inspection of butter as it is received at the New York, Chicago, and San Francisco markets, this inspection being made at the request of the dealer or producer and the defects being pointed out and suggestions made for remedying them. The competition among creameries for the purchase of cream, however, has resulted in cream being accepted which is sometimes in very bad condition, and as a result much creamery butter of an inferior quality is placed on the market. The Department is endeavoring to encourage improvement in the quality of creamery butter by inducing the creameries to discriminate against bad cream and by encouraging farmers to send their cream in a fresh and wholesome state. It is found that good cream naturally produces a higher grade of butter, which commands a better price on the market, so that good cream should yield the farmers a better price.

IMPROVEMENT OF MILK SUPPLIES.

The Department has also continued to work both independently and in cooperation with city authorities for the improvement of public milk supplies. The score-card system of dairy inspection is recommended and has given good results in improving the sanitary condition of dairies. It is being used in 117 cities and towns, including some of the largest cities in the country. As a result of these cooperative efforts great improvement has been brought about in the milk supplies of a number of cities.

After the milk dealer has delivered wholesome milk to the consumer it is important that the latter should handle and keep it in a sanitary manner until it is used. To meet the needs for information on this subject the Department has issued a Farmers' Bulletin on "The Care of Milk and Its Use in the Home," which is being widely distributed.

DAIRY PRODUCTS INVESTIGATIONS.

Investigations regarding the manufacture of butter and cheese and the bacteriology and composition of milk have been continued. Additional work during the year has confirmed the previous conclusions as to the superior keeping qualities of butter made from pasteurized sweet cream. Studies have been made to determine the best temperature for pasteurizing cream for butter making, and 160° F. seems to give the best results.

A bacteriological study has been made of commercially pasteurized and raw market milk as publicly sold in three large cities, from which it is concluded that there is no development of bacteria in such pasteurized milk that could be said to make it more unsafe than raw milk kept under similar conditions.

Investigations into various problems involved in the manufacture of cheese of the Swiss, Cheddar, Camembert, and Roquefort types have been continued, some of this work being done in cooperation with the Wisconsin and Storrs, Conn., agricultural experiment stations. The method of making cheese of the Cheddar type from pasteurized milk has been so improved that it is possible to bring factory milk into practically uniform condition every day, so that a definite routine method of manufacture may be followed throughout the year. The cheese produced by this method has been of high and uniform quality with almost perfect texture, and has commanded the highest market prices.

ERADICATION OF ANIMAL DISEASES.

For several years the Bureau of Animal Industry has been engaged in systematic work for the eradication of certain contagious diseases of live stock, and during the past fiscal year unusually good progress has been made.

TICK ERADICATION.

The work for the extermination of the ticks which spread the contagion of southern or splenetic fever of cattle means much for the future of cattle raising, dairying, and general agriculture in the South. Aside from communicating the disease mentioned, these ticks have such an adverse effect upon the condition of cattle which they infest that it is almost impossible to breed and raise a good quality of cattle in the tick-infested region. Since the summer of 1906 the Department has been engaged in an effort, in cooperation with state and local authorities, to exterminate these ticks. During the past fiscal year, as a result of the eradication of ticks, there were released from quarantine 57,518 square miles of territory, which is the largest area released in any one year since the beginning of the work. The total area so far released amounts to 129,611 square miles, an area greater than the combined territory of the States of North Carolina, South Carolina, and Tennessee. The States in which areas

have been released from quarantine are Virginia, North Carolina, South Carolina, Georgia, Kentucky, Tennessee, Mississippi, Arkansas, Oklahoma, Texas, and California. The work is also being carried on in Missouri, Alabama, and Louisiana.

In the sections that have been freed from ticks and released from quarantine it is now practicable to introduce and raise a better class of cattle, and the cattle in these regions are more thrifty and command substantially better prices, not only because of their better condition but because they can be marketed without quarantine restrictions.

SCABIES OF SHEEP AND CATTLE IN THE WEST.

For more than ten years the Department has been working in cooperation with state authorities to eradicate the disease known as sheep scab, which has heretofore been prevalent in the West. During the fiscal year 390,000 square miles of territory under quarantine on account of this disease were released, comprising the entire State of Washington and parts of Oregon, Nevada, Utah, Arizona, and Colorado. It was found necessary to place a quarantine on the State of Kentucky on account of the continued spread of this disease in that State. At that time there was no efficient state law under which the Department could cooperate in combating the disease, but the last session of the Kentucky legislature passed an act creating a state live-stock sanitary board with power to deal with infectious and contagious diseases of animals, and arrangements have now been made to carry on cooperative work in that State for the eradication of sheep scab.

As a result of similar work for the eradication of scabies of cattle there were released from quarantine during the fiscal year 53,021 square miles, consisting of areas in Montana, Wyoming, Colorado, Nebraska, Kansas, and Texas.

In connection with the work for the eradication of scabies in sheep and cattle, employees of the Bureau of Animal Industry made 52,749,920 inspections of sheep and 18,190,456 inspections of cattle, and supervised 12,153,356 dippings of sheep and 1,336,829 dippings of cattle.

NECROBACILLOSIS IN SHEEP.

About two years ago a form of necrobacillosis, known as lip-and-leg ulceration of sheep, appeared in Wyoming in such a malignant form and spread to such an extent as to necessitate a Federal quarantine in August, 1909. The Bureau of Animal Industry has made scientific and practical studies of this disease and of methods of treatment, and has conferred and cooperated with sheepmen and state authorities in repressing it, with the result that its prevalence has been greatly reduced. The drought of the past season has afforded favorable conditions for combating the disease and has also no doubt

contributed somewhat to the good results. A circular describing the disease and recommending methods of treatment was prepared and issued by the Bureau and has been widely circulated in the affected region. The Bureau has also kept a force of veterinarians in the field to assist in treating the disease as well as to enforce the quarantine. About one-fourth of the quarantined area has been released, and the number of cases of the disease in the territory remaining in quarantine has been greatly reduced, besides which the extension of the disease to other sections has been prevented.

BOVINE TUBERCULOSIS IN THE DISTRICT OF COLUMBIA.

It has been well known in recent years that tuberculosis exists to a considerable extent among the cattle of the United States, especially among dairy cattle, and that where no adequate steps have been taken for the suppression of this disease it has increased in prevalence and extended to hogs. During the past two years the Department has made special investigations to determine the prevalence and extent of tuberculosis among cattle of various parts of the country, and has studied methods of eradication. The Bureau of Animal Industry has given active aid to state and municipal authorities and to individuals in suppressing this disease.

As the District of Columbia is under the jurisdiction of the Federal Government, it was thought well to undertake the eradication of tuberculosis from the cattle of the District, both in the interest of a wholesome milk supply and as a demonstration of what could be accomplished by certain methods of dealing with the disease. A cooperative arrangement was entered into with the Commissioners of the District, whereby all the cattle in the District were tested with tuberculin and those that reacted were slaughtered under inspection. Condemned cattle were appraised before slaughter, and reimbursement was made to the owners from Department funds on a scale depending upon the result of post-mortem examination. Over 18 per cent of the cattle in the District gave reactions to the tuberculin test, and in 98½ per cent of these the lesions of tuberculosis were demonstrated on post-mortem examination. All new cattle brought into the District have to be submitted to the tuberculin test, and it is also proposed to retest the herds at intervals so as to detect any cases that may have developed since the first test. As a result of this work the cattle of the District are already practically free from tuberculosis, and it is believed that by continuing the retests for a reasonable time the disease will be completely eradicated from the cattle of the District.

Cooperation has also been extended to the States of Maryland and Virginia in applying the tuberculin test to cattle in those States.

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HOG CHOLERA.

The efficiency of the method of serum treatment devised by the Bureau of Animal Industry for the prevention of hog cholera has been still further confirmed by practical experiments during the past year. A striking demonstration was made at the Kansas City stock yards. Out of a lot of 35 pigs, 22 were injected with Bureau serum, 4 were inoculated with virulent hog cholera blood, so as to give them the disease, and 9 were not treated in any manner. All were placed in a pen together. The 4 inoculated pigs contracted hog cholera and died, also the 9 untreated pigs, while the 22 pigs treated with serum remained well. A similar experiment at South Omaha gave equally good results.

The Department has continued its efforts to encourage and assist state officials in preparing the serum for sale or distribution to hog raisers, and has also carried out scientific experiments with a view to improving the methods and reducing the expense of producing the serum. It has been shown beyond doubt that this serum is an efficient agent for protecting hogs against hog cholera and that by its use in a systematic way this disease can probably be eradicated.

SCIENTIFIC INVESTIGATIONS OF ANIMAL DISEASES.

The Bureau of Animal Industry has continued its scientific investigations into the nature and cause of various diseases of animals. Considerable attention has been given, as heretofore, to tuberculosis, and especially to methods of immunizing cattle against this disease. The only methods of immunization which have given promising results have required the use of living tubercle bacilli, so that these methods can not be considered free from danger, and the Department is not yet prepared to recommend their use.

Other diseases under investigation during the past year are lip-and-leg ulceration of sheep, swamp fever of horses, chronic bacterial dysentery of cattle, bighead of sheep, glanders of horses, rabies, and anthrax. Experiments made at the suggestion of a European correspondent with a new method for the diagnosis of glanders have shown the great value of this method, and indicate that it will be found much more satisfactory and reliable than the mallein test and other methods heretofore in use, especially in the detection of incipient cases.

As injurious results sometimes follow the feeding of cotton-seed meal, experiments have been under way with a view to determining the cause of this trouble and learning if possible how this valuable feed may be utilized without danger. Laboratory experiments have indicated that cotton-seed meal made from certain varieties of cotton, or meal in the manufacture of which a high temperature is applied, may show poisonous properties, while the meal from other

varieties and that made in other ways is harmless. Work is in progress on the identification of the specific poisonous principle and the further elucidation of the various problems encountered.

The number of rabid animals brought to the Department for diag nosis indicates the continued prevalence of rabies in and around the District of Columbia and other regions. During the fiscal year 116 cases were examined, consisting of 100 dogs, the remainder being cattle, calves, mules, and sheep. These animals had bitten at least 59 persons and 46 animals, so far as known. Seventy-five of the suspected cases were found to be positive. Experience has shown that the muzzling of all dogs for a sufficient period is the best means of reducing and eradicating this dangerous disease.

BLACKLEG VACCINE, TUBERCULIN, AND MALLEIN.

The Bureau of Animal Industry has continued the preparation and distribution of vaccine for the prevention of blackleg in young cattle, and the returns show a still further reduction in the losses from this disease. During the fiscal year about 1,000,000 doses of this vaccine were distributed among stock raisers.

The activity of various state and municipal veterinary and health officers has resulted in an increased demand for tuberculin, which is supplied by the Department to such officials free of charge for use in the diagnosis of tuberculosis in cattle. About 350,000 doses were prepared and distributed during the fiscal year. Nearly 75,000 doses of mallein for the diagnosis of glanders in horses were also prepared and distributed.

INSPECTION OF EXPORT ANIMALS.

The Bureau of Animal Industry made during the fiscal year 328,078 inspections of animals for export, including 62,372 inspections of Canadian animals in transit. There were inspected on arrival at British ports by Bureau inspectors stationed there 193,259 animals from the United States and Canada. During the year 443 inspections of vessels carrying live stock were made in order to see that equipment, ventilation, feed, water, attendants, etc., conformed to the regulations.

INSPECTION AND QUARANTINE OF IMPORTED ANIMALS.

In order to prevent the introduction of contagious diseases of live stock the Bureau makes a rigid inspection of all imported animals at ports of entry, and in certain cases a quarantine is imposed. During the fiscal year 346,650 imported animals were inspected, 9,783 of which were also quarantined.

LEGISLATION NEEDED.

The work of the Department in dealing with the live-stock industry, and especially with communicable diseases of animals, has shown

the need of further legislation by Congress in order to remedy defects in existing laws and to confer authority for additional work in the public interest. These matters are discussed in more detail in the report of the Chief of the Bureau of Animal Industry, but may be briefly enumerated as follows:

Authority for the Secretary of Agriculture to control the importation of vaccines, serums, antitoxins, tuberculins, and other preparations sold for the detection, prevention, or treatment of diseases of animals, and to supervise the preparation of such products manufactured in this country for interstate commerce; such authority to be similar to that already vested in the United States Public Health and Marine-Hospital Service with regard to such products used in human medicine.

Authority for the Secretary of Agriculture to waive the provisions of the so-called twenty-eight-hour law in cases of emergency when cattle are being shipped under quarantine restrictions and a strict compliance with the law might cause the spread of disease.

Authority for the Secretary of Agriculture to require the disinfection of any live-stock cars used in interstate commerce whenever such disinfection seems necessary to prevent the spread of disease.

Authority to regulate the shipment of different classes of live stock in the same cars in the interest of humane treatment and so as to prevent young and small animals, frequently of different species, from being trampled to death by larger ones.

Legislation prohibiting the shipment of dead animals in the same cars with live animals, a practice that prevails to some extent and is a source of danger of the spread of contagious disease.

Legislation providing for the inspection and supervision of dairy products in interstate commerce, with a view especially to preventing the widespread practice of shipping to creameries cream that is in such a condition as to be unfit to enter into the composition of a food product.

An amendment to the present law regarding renovated or process butter, so as to apply to this product the provisions of the meat-inspection law so far as they may be applicable.

NEW EXPERIMENTAL FARM.

Under an item in the appropriation act for the Department of Agriculture for the current fiscal year an experimental farm at Beltsville, Md., has been purchased for the use of the Bureau of Animal Industry. This farm will provide facilities that have long been needed for experiments and investigations in breeding and feeding animals and in dairying, so that work of this kind can be kept separate from that relating to infectious diseases as carried on at the Bureau's experiment station at Bethesda, Md.

BUREAU OF PLANT INDUSTRY.

The Bureau of Plant Industry has continued its studies of plants in all their relations to agriculture.

PROBLEMS IN PLANT PATHOLOGY.

The crown-gall of cultivated plants has been shown to be cross-inoculable to an astonishing degree. Galls have been produced on various species belonging to widely different families by pure-culture inoculations with *Bacterium tumefaciens* isolated from the Paris daisy. This organism has been inoculated many times successfully into the peach, rose, hop, sugar beet, white poplar, and other susceptible plants. That from the crown-gall of peach has been many times inoculated into the Paris daisy, sugar beet, hop, and other plants. Successful cross-inoculations have also been obtained with the organisms isolated from the crown-galls of many other plants, among them apples affected with hairy-root, the cause of which has so long been a matter of conjecture and dispute.

A destructive tumor disease of limes and other citrus fruits has been shown to be of fungous origin and to attack not only limes, on which it was first observed, but oranges also, while artificial infections have been produced on pomelo, lemon, and *Citrus trifoliata*. Mycelium has been traced in the stem from 1 to 2 feet beyond any external sign of infection.

An extensive study has been made of the bud-rot of the coconut palm, which has caused enormous losses. The cause of the disease has been determined and extensive experiments carried on with a view to its prevention and eradication.

Considerable work has been done during the past year upon a new spot disease of cauliflower. The cause has been determined, a biological study of the parasite made, and many experiments carried on to determine the conditions under which infection takes place.

Studies are also being made of the bacterial and fungous content of spoiled maize; the inter-relation of crown-gall organisms; the new and destructive Grand Rapids tomato disease; banana diseases, especially a very destructive blight of the whole plant, and of all sorts of bacterial diseases of plants.

FRUIT-DISEASE INVESTIGATIONS.—The new methods of spraying with sulphur compounds worked out by the pathologists of the Department have been widely adopted by apple growers. The investigations have shown that fine fruit can be produced and protection secured against fungous diseases without the injurious effects resulting from the use of copper compounds.

Bordeaux mixture is still probably the most effective all-round fungicide, but in the spraying of the apple it has to take second place, to be used only for special purposes, such as late treatment for bitter-

rot. Special attention has been given to experimental work in perfecting the method of using the new sulphur sprays for the fruit-spot and leaf diseases, and in cooperation with the Bureau of Entomology studies have been made of the combined sprays of the sulphur and arsenic compounds, with which both diseases and insects were treated at the same time. In most cases fruit growers who have used the new sprays have secured fine crops of the best apples they have ever grown. The new types of spray injuries which resulted are unimportant and are probably avoidable.

The fruit-spot and leaf disease known as cedar rust or orange rust of the apple has been increasing in prevalence in the Blue Ridge and Allegheny Mountain district from Pennsylvania to Tennessee during the last few years. This past season the worst outbreak of this malady ever known has occurred. It has attacked mainly the York Imperial, but the Yellow Newtown and some other varieties have been affected. The fungus has its alternate generation on the red cedar. Previous investigations by pathologists have shown that the immediate proximity of cedars greatly favors the disease. Recommendations made in previous years to cut down cedars from the vicinity of commercial apple orchards have not been taken very seriously. During the present season, however, many cedars in dangerous proximity to orchards have been removed. The disease has not heretofore proved amenable to spraying, but it was shown during the last season that spraying will very largely prevent it if applications are made just before the period of general infection.

For two years attention has been called to the discovery of self-boiled lime-sulphur as a fungicide which can be used in the summer spraying of the peach for brown-rot and scab. In 1909 this spray was successfully used in combination with arsenate of lead. The preliminary experiments of last season were redemonstrated on a large scale in Georgia, Virginia, and West Virginia, resulting in a complete victory over the combination of fungous diseases and insect enemies. The promptness with which peach growers have accepted the discoveries is encouraging. The growing of fine peaches has received a great impetus through the removal of some of the factors which render the growing of this fruit uncertain.

On the Pacific coast the work of controlling pear-blight by eradication methods has been successfully carried out. In the Rogue River Valley of Oregon and in many districts of California the disease was decidedly less prevalent during the past season than at any time since the blight entered.

It has been demonstrated on the Pacific coast that the powdery mildew of the apple can be satisfactorily controlled by spraying.

Experiments in spraying for pecan scab were continued in South Carolina, and similar experiments were started in Georgia. Though

the disease can be controlled by spraying, the desirability of avoiding it by the use of resistant varieties was made clear. Many of the commercial pecans are sufficiently resistant to serve the purpose admirably and may be top-grafted on affected varieties.

STUDIES IN FOREST PATHOLOGY.—The chestnut-bark disease has now spread to northern Massachusetts and New York, western Pennsylvania, and eastern West Virginia. There are, however, certain indications that it may not become serious south of the Potomac. The work of this Department has shown that with young ornamental trees and orchard trees the disease may be controlled by a cutting-out and pruning system, though this method is impracticable with large ornamental trees and forest trees. In localities where the disease is just appearing its progress can be materially checked, and perhaps prevented, by promptly cutting down the infected trees and burning up at least the bark and brush. After 25 per cent of the trees are infected it is too late to do anything. It is unfortunate that in matters of this kind greater cooperation by private owners is not possible. Had this disease started in a National Forest district having a cooperating pathologist it probably would have been eradicated as a matter of routine before infection became general.

White-pine seedlings diseased with blister rust appear to have been imported into some 230 localities in North America. All diseased seedlings thus far located have been destroyed, but it is by no means certain that all importations have been found. This disease affects mature trees, as well as nursery stock, and occurs not only on the white pine, but on the sugar pine, the western white pine, and probably all other five-needled pines. The importation of white-pine seedlings should be flatly prohibited, as the damage which this disease can do, and probably will do, if once established in America, is out of all proportion to the value of all white-pine seedlings ever imported or likely to be. Prohibition is the only efficient means of prevention, as the disease can not be detected in the shipment by any system of inspection.

One of the most discouraging features of reforestation is the prevalence in the forest nursery of damping-off and other seedling diseases which may sometimes destroy the entire annual output of a nursery, especially of coniferous seedlings. One of the commonest of these diseases, popularly called "blight," has been controlled at the Forest Service nursery at Halsey, Nebr., by slight and perfectly practicable changes in the management of water supply and shade. Damping-off of eucalyptus seedlings, a source in the past of great loss, proves to be preventable by selecting the proper soil for planting.

Data collected in the forest-disease survey indicate that in America timber decay and tree disease are second only to forest fires as causes

of loss. In theory it is easy to remove diseased trees in the forest when cuttings are made, leaving only healthy individuals for seed trees, and so continually improve the health of the forest; but in practice so many questions of economy and differing local conditions are involved that many difficulties must be overcome. A great deal of attention will be given to working out this problem.

COTTON AND TRUCK-CROP DISEASES.—The wilt-resistant varieties of cotton and cowpeas which the Department has been breeding and disseminating for several years have been brought to a higher standard than ever before, but wilt and root-knot have been spreading faster than the improved varieties have come into use, so that many thousands of acres continue to be destroyed each year. The problem now is to reach the farmers with the new seed and methods. For this purpose a special campaign of education is being inaugurated, to develop breeders of the new cotton and cowpeas and to demonstrate the effectiveness of the improved varieties.

A rust-resistant asparagus has finally been secured, and the stock is being propagated with all possible dispatch.

New prominence has come to the potato wilt, a disease known for some years, by the discovery that it is very widespread and injurious in an inconspicuous form, causing premature ripening, as well as dry-rot in storage. It must be more widely understood, and preventive measures, such as longer rotations, must be adopted.

Black-leg, another new potato disease, is increasing through the use of infected seed, especially in eastern trucking districts. Internal brown-spot is common. The present varieties of potatoes are somewhat limited in their climatic adaptations, and the diseases that affect them emphasize the importance of a broadly planned line of breeding to develop new potatoes possessing disease resistance and stronger local adaptation through bringing from South America or elsewhere new strains for hybridization. Potatoes for the warmer States are especially needed.

Potato wart, a new disease that is likely to prove very destructive if introduced into this country, has been causing alarm in Europe. Canada, Ireland, and other countries are quarantining against it, but the United States has no protection. It has already appeared in Newfoundland and has been brought once to Massachusetts. Several other diseases now in foreign countries may be introduced at any time. The experience with the chestnut blight illustrates the devastation that may ensue. This may even yet be repeated on a larger scale than with the white-pine blister rust unless Congress authorizes the Secretary of Agriculture to prohibit the entry of diseased plants and seeds.

WORK ON SUGAR-BEET IMPROVEMENT.

A campaign is being carried on to increase the average yield per acre of sugar beets. The tonnage produced in the United States is

still lower than it should be. Some sections do not appreciate the need for thorough culture; others have attempted to grow beets continuously, and need to adopt rational systems of crop rotation. All need to maintain the fertility of the soil and to make beet growing a part of the system of permanent agriculture. Diseases are the underlying causes of low tonnage in some districts, and there the Department is concentrating its efforts to determine the best means of relief.

The improvement of American beet seed is being given much attention, and there are indications that the quantity grown in this country will increase greatly in the near future.

SOIL-BACTERIOLOGY AND WATER-PURIFICATION INVESTIGATIONS.

The results reported by cooperators using cultures of nodule-forming bacteria for inoculating legumes have indicated certain limitations to successful inoculation. Especially with alfalfa in the Coastal Plain region it has been found that inoculation is generally successful upon soils which produce a blue or neutral reaction to litmus paper, while upon those soils giving a red reaction to neutral litmus paper successful inoculation is seldom obtained. Extensive studies upon the nitrifying power of soils have been carried on in different parts of the United States, and a close relationship has been established between the nitrifying power of a soil and its crop-producing power. In none of the regions under investigation has any injurious effect from overnitrification been observed.

PROGRESS IN ACCLIMATIZATION AND ADAPTATION OF CROP PLANTS.

ACCLIMATIZATION OF NEW VARIETIES OF COTTON.—There are many desirable varieties of cotton, corn, and other economic species in the tropical countries where these plants had their origin and were first domesticated. The use of these superior varieties in the United States has been considered impracticable, owing to their general failure to produce a crop within the limits of the summer season. It has now been learned that the behavior of many of these imported varieties when first planted in the United States is abnormal and that they can be led back to normal fertility and earliness by a few seasons of acclimatization and selective breeding.

Several new types of Upland cotton have been introduced from Mexico and Central America and acclimatized in Texas. Although they yielded very little cotton at first, they have now become as productive and as uniform as any of the United States Upland varieties that are being tested in the same places. Some of the new types produce larger bolls and longer lint than any of the varieties now generally cultivated in Texas, and these advantages occur in combination with other desirable qualities, such as extreme earliness, tolerance of drought, and resistance to the attacks of the boll weevil.

Local adjustment of cotton varieties.—The same biological factors of abnormal behavior that make it necessary to acclimatize imported varieties have also been found to affect the United States Upland varieties. A carefully bred variety that is uniformly early and productive in its home district may show much individual diversity when carried to a new place and may require a new course of selection to give it complete adjustment to the new locality. A large proportion of the plants that depart from the standards of the variety become distinctly inferior, like the reversions that occur more frequently in hybrid stocks and in primitive unimproved types of cotton. Failure to remove inferior "rogue" plants is one of the causes, if not the principal cause, of the rapid "running out" of varieties of cotton when selection is relaxed. Continued selection is necessary as a regular farm operation to maintain the uniformity and productive efficiency of high-grade varieties.

Extension of cotton culture in the United States.—There is a general impression that the cotton-growing lands of the United States are all occupied and that the presence of the boll weevil will prevent any future increase of this crop, but this is a mistake. There are large possibilities for cotton production in the drier parts of the Western and Southwestern States, where the boll weevil can do little damage.

Experiments in Texas, Kansas, Arizona, and California indicate that cotton of excellent quality can be produced in many regions where none has been grown in the past. The status of the cotton as a dry-land plant is still very inadequately appreciated. It yields a marketable product with less water than any other crop now grown in the Southwest. A small amount of irrigation can be used more effectively with cotton than with any other crop, and even without irrigation cotton can often be grown on lands not now supposed to have agricultural possibilities.

Increased yields from corn hybrids.—Numerous experiments have shown that crosses or hybrids between two kinds of corn are usually more productive than either of the parent varieties. Even in crosses of improved strains the yields are notably increased, sometimes more than 50 per cent, and the crossed plants are more resistant to disease and to unfavorable conditions of growth. Simple methods have been devised to enable corn growers to take advantage of this factor of increased production.

DRUG-PLANT INVESTIGATIONS.

During the past year the camphor work has made considerable progress. Seeds selected from trees showing a high camphor content have been propagated under various conditions, with the result that enough young trees are now ready to plant a large part of the test

areas. The effort to secure improved apparatus for working up this crop has been continued with much success. Especial attention has been given to the development of the best form of condensing apparatus. The area of camphor planted as a result of private enterprise continues to increase at an encouraging rate.

In South Carolina the paprika-pepper crop has increased in size. The Department is supervising the growing of about 50 acres of peppers on a number of types of soil in different localities. Thus far the present crop promises to exceed former crops considerably. The reception of these peppers by spice millers has been favorable, and the demand for a large home-grown supply seems established. Work has been chiefly centered on paprika peppers of the Hungarian type, but since the market for the Cayenne type is much larger, future efforts are to be directed toward the production of pungent peppers. A growing demand is felt for a mild sweet pepper of high color, similar to the so-called "Spanish paprika," now imported in large quantities. Work on this important sort has demonstrated the great liability of this group of plants to disease, and ways of meeting this difficulty are being worked out. As soon as success is secured a material widening of the market for American-grown peppers will follow.

The hop work of the past year has been directed toward the improvement of varieties and toward better methods of handling the plants in the field. A statistical study of a small area has shown that in all probability certain methods of practice exert more effect than has been suspected. For example, it appears that a better yield is obtained when four to six vines are trained in a hill than when fewer are permitted to grow. The criteria to be used in judging hops are an important object of study also. At present there seems to be much disagreement among hop experts as to what constitutes the fundamental basis of quality. A study of certain constituents, especially of volatile oils, resins, and acids, is designed to throw light on this important question.

Work on tanning crops has been continued on a small experimental basis, test plats of promising plants being grown in different testing gardens of the Department. The commercial and agricultural requirements that must be met in order to bring success are many and rather exacting.

The tea work has been continued in South Carolina. Last season's outcome was very satisfactory from the standpoint of production and quality, and the increasing demand for American tea quickly absorbed the crop. More tea was sold in the Southern States than heretofore. Work on the pruning machine after many trials seems to have resulted in a practical means of eliminating a large item of expensive hand labor. Pruning, heretofore costing about $2.25 per acre, can now be done equally well at 50 cents an acre.

Perfumery-plant and volatile-oil investigations have shown that many of the foreign plants used for purposes of volatile-oil production can be grown and distilled satisfactorily in this country. A study of the native oil-bearing plants has developed the fact that among them are several species yielding oils containing constituents which make the foreign oils now imported commercially insignificant. For example, the native horse mints and their near relatives, growing luxuriantly on waste lands, yield oils rich in thymol, a valuable and much-used antiseptic now derived from foreign sources. Certain of the sagebushes of the arid plains of the West yield oils rich in substances now in demand. Native plants are well worthy of further study in this direction.

It sometimes happens that crude drugs come on the market in a more or less mixed condition, a situation at times not detected by the manufacturer or pharmacist using them; consequently, confusion as to the facts concerning crude drugs of native origin at times creeps in. Some time since the drug known as pinkroot was investigated by the Department, and the true status of the situation made clear. During the past year the same thing has been done with the wild-yam root, the true and the false types having been distinguished and the botanical sources of each ascertained.

POISONOUS-PLANT INVESTIGATIONS.

The field work on poisonous plants during the past year has consisted of two types: (1) Feeding experimentation, carried on at a temporary station located at Mount Carbon, Colo., and (2) reconnaissance work, carried on wherever complaints of considerable losses have seemed to demand attention. At Mount Carbon the harmful effects of larkspur poisoning due to species of *Delphinium* have been under study. The chief features of larkspur poisoning have been ascertained, and some progress has been made on relief measures.

In connection with reconnaissance work much attention has been given, as heretofore, to trouble in the National Forests. Frequently, as a result of a study of the flora of a suspected area, the source of loss has been identified and simple measures which have reduced the loss have been suggested.

Laboratory studies have been directed toward a variety of subjects, among others the further understanding of the loco-weed problem. It has been shown that the cause of this important disease is not yet well understood, and further work seems to be required. This is now in progress.

The relation of corn to pellagra has continued to receive attention. The normal constituents of corn and such as are developed under the action of agencies bringing about its deterioration have been sought in the hope of getting some light on the cause of this malady.

Some effort has been spent on a study of the alkaloids of the common solanaceous berries, both wild and cultivated. The utilization of a number of sorts for table use, together with reports of their harmful action, has made it necessary to get more information on the properties of these products.

PROGRESS OF WORK IN AGRICULTURAL TECHNOLOGY.

Official cotton grades.—Among the various technological problems carried forward within the past year, the work of cotton grading has been prominent, and in accordance with the recent act of Congress nine official grades of white American cotton have been promulgated. Twenty-five sets of these types have been prepared for storage in vacuum for the purpose of comparison in future years. This method of securing the permanency of the types is believed to be a most fundamental and important improvement over methods previously in use. A limited number of sets of the grades were placed with agricultural colleges in the cotton belt and with exchanges, institutions, and individuals who had rendered service in connection with the project and whose facilities were at the disposal of the Department for quickly bringing the official types to the attention of the cotton industry. Before this preliminary distribution was finished the general sale of the grades was begun, and the official types have for some time been supplied to all applicants at the cost of preparation, so that the sets now in practical use cover a much wider territory.

The official grades were established with the advice of a committee composed of men of the highest standing drawn from every department of the cotton industry. Numerous letters approving these grades have been received from prominent American cotton interests, while prominent members of foreign exchanges who have seen the official types have expressed themselves in terms of high commendation. In no case have the official types been subjected to hostile criticism.

Original methods of preparing and preserving these types have been developed, and the integrity of each box is attested by a full-sized photograph of its contents, which is secured in its cover and bears the certificate of the Secretary of Agriculture and the seal of the Department.

Investigation of the length and strength of cotton fiber, with a view to measuring these qualities more accurately, has been actively prosecuted, and great progress has been made, while the problems of cotton marketing have received further study in the field. A new method of measuring the length of cotton staple by projection, which it is believed will prove of very great value to the cotton industry, has been devised and perfected.

Paper-plant investigations.—Technological work on crop plants which may be used for making paper has been actively prosecuted during the year and has resolved itself into an investigation of three classes of material: (1) Wastes or by-products of farm crops, such as the stalks of corn and broom corn; the straws of rice, flax, etc.; hemp waste; and bagasse; (2) plants which give promise of being profitably grown expressly for paper-making purposes, such as hemp, esparto, and jute; and (3) wild plants which are locally abundant and possibly suitable, including certain grasses, rushes, sedges, and canes.

Strikingly favorable results have been obtained from broom-corn stalks, which have been tested in lots up to 3½ tons and found to yield as high as 42 per cent of available fiber, which, when combined with an equal quantity of poplar pulp, produced a good quality of book paper. It can be conservatively stated that this crop by-product is suitable for immediate use in paper making. The pulping of cornstalks has not been as satisfactory, but good qualities of paper of different finishes have been produced from numerous varieties of corn.

FIBER INVESTIGATIONS.

In the fiber investigations of this Department special attention has been given to hemp, flax, and sisal. The importations of these three fibers during the fiscal year ended June 30, 1910, amounted to 119,150 tons, valued at $16,016,416. Hemp grown in 1909 in Wisconsin, in cooperation with the Wisconsin Agricultural Experiment Station, has been retted and broken, and the fiber has been sold to manufacturers at very satisfactory prices. Cooperative experiments were continued in Wisconsin in 1910, and a series of similar experiments was begun in Iowa. The hemp made a very satisfactory growth considering the unusually dry season in those States. It has been harvested and spread for retting.

Flax from seed of carefully selected plants of fiber-producing types was grown in nursery plats in eastern Michigan. A study has been made in the field of the flax grown for fiber in Michigan and of that grown for seed in Minnesota and adjacent States. Selections of plants have been made with a view to the development of uniform varieties having the characters most desired for these special uses. Attention is also being devoted to an increased production of flaxseed to meet the growing demand for this seed in the manufacture of linseed oil.

Sisal, henequen, and zapupe plants cultivated in cooperation with the Porto Rico Agricultural Experiment Station and the Porto Rican government are making a very satisfactory growth.

A planting of sisal and allied fiber-producing agaves and furcræas has been made in a cooperative experiment on Sugar Loaf Key,

Florida. The young plants have made a very promising growth. The conditions of soil and climate on the Florida keys are very similar to those in the Bahamas, where the production of sisal has become the leading industry in recent years.

GRAIN STANDARDIZATION.

That the relations between scientific agriculture and the commercial conditions which affect crops after they are produced are important has of late come to be more fully realized. To improve market conditions where possible is to render a valuable service to agriculture.

With this object in view the Department has undertaken a scientific study of the commercial conditions which affect the grain crops after they have been produced—specifically, a study of the methods employed in harvesting, storing, transporting, grading, and marketing these crops and the extent to which the various methods affect their relative commercial and intrinsic values.

Extensive experiments have been carried on with corn stored under actual commercial conditions in country and terminal grain elevators at various points. Rail shipments of corn from points within the surplus-corn States to export points upon the Atlantic and Gulf seaboards and shipments of a cargo of corn from each of these seaboards to European ports were accompanied in each case by an expert who had the corn under careful observation at regular intervals en route. Many rail shipments of corn, principally between the large grain markets, were examined and tested at the points of shipment, and also at their destinations. Corn stored in farm cribs at various points was also under observation at regular intervals.

The most important fact demonstrated is that a large proportion of the corn which finds its way into commerce contains excessive quantities of moisture, that under most favorable conditions no appreciable reduction of this moisture takes place until March and April, and that this excessive moisture is the primary cause of corn spoiling in large quantities under commercial conditions.

The methods of handling and marketing wheat have likewise been studied during the year. More than 300 samples of the various varieties, classes, and grades of wheat were obtained. In cooperation with the North Dakota Agricultural Experiment Station, these samples were experimentally milled and baked with a view to correlating the physical characteristics of wheats with their flour and bread making qualities. The present indications are that these factors may be correlated and a better understanding of wheat values brought about.

The effect of excessive moisture, "weathering," and the sulphur bleaching of commercial oats and barley has likewise been studied during the year, and much information relative to these subjects was obtained.

The results of laboratory experiments with commercial flaxseed indicate that this seed will increase considerably in volume and decrease proportionately in test weight per bushel while being handled and stored commercially, probably on account of the abrasion or roughening of the seed coat during the various handlings necessary.

SEED-TESTING LABORATORIES.

During the past year additional seed-testing laboratories have been opened in cooperation with the North Carolina Department of Agriculture and the Purdue University Agricultural Experiment Station. The laboratories in Nebraska, Missouri, and Oregon have been continued. The work of each of these laboratories has increased approximately 50 per cent each year since they were started, showing the interest taken in them by the public. The Department is cooperating with state institutions in order that the work may be done locally when analyses can be furnished, with a great saving of time.

During the summer a number of representatives of seed firms have taken advantage of the opportunities offered by the laboratory to become familiar with the technique of seed testing in order to carry on similar work for themselves.

Samples of forage-plant seeds have been collected and examined for the presence of adulterants, and the names and addresses of the dealers who offered adulterated seeds for sale have been published, as formerly, with the result that fewer lots of adulterated seeds have been found the past year than in any preceding year.

PROGRESS IN GRAIN INVESTIGATIONS.

Winter-wheat extension.—For some time efforts have been made by the Department to extend the area of possible cultivation of hard winter wheat by the introduction of varieties hardier than those now grown. The Kharkov variety, which so far has been found to be the best, has given unusually good results this season. The total annual production of this wheat is now between 15 and 20 million bushels.

Durum wheat.—In the last report the annual production of durum wheat was stated to be nearly 50 million bushels, but it is no longer possible to give even approximate statements of the production. Durum-wheat flour is commonly used in a number of eastern cities, particularly Baltimore, Washington, and Richmond, a single firm having disposed of five carloads in the last-named city in three months. For the first time a prominent milling company is advertising the flour on its own merits, a matter which has been urged by this Department for some time.

Pacific coast investigations.—Following the demonstration of the adaptation of Chul and Fretes wheats to California by this Department, seed of pure strains is being increased as rapidly as possible

for distribution. Already the yields obtained show the superiority of these varieties.

INFLUENCE OF ENVIRONMENT ON THE COMPOSITION OF GRAIN.—Experiments conducted for a considerable length of time seem to show that different kinds of soil have very little influence on the quality or yield of grain, but that changes of climate have considerable effect.

CROPS IN ROTATION WITH CEREALS.—Rotation experiments have been conducted in a number of places to determine what crops are best for growing in alternation with cereals in order to obtain the best results with the latter. Where legumes were employed in these rotations the results have confirmed those of other experiments in showing the importance of such crops preceding wheat. In California the value of green rye turned under in preparation for wheat seeding was also shown. Both rye alone and a mixture of rye and vetch plowed under green gave a very much greater yield of wheat than that obtained on summer fallow, and a still greater increase over that obtained where wheat followed wheat.

TIME AND RATE OF SEEDING GRAINS.—From several years' investigation of the best time and rate for seeding grains the chief conclusion of general interest is that a smaller quantity of seed may be employed in the drier districts than in humid areas. The proper quantity of wheat, for example, to be sown to the acre in semiarid districts averages nearly 3 pecks, while in the humid portions of the eastern United States it is common to sow from 5 pecks to 2 bushels.

DRY-LAND GRAIN INVESTIGATIONS.—Dry-land grain experiments are now conducted at Amarillo and Dalhart, Tex.; Akron, Colo.; Bellefourche and Highmore, S. Dak.; Williston and Dickinson, N. Dak.; Philbrook, Mont.; Nephi, Utah; and Moro, Oreg. The farm at Moro, Oreg., was added during the year and is conducted in cooperation with the Oregon Agricultural Experiment Station.

GRAIN-SORGHUM INVESTIGATIONS.—Selected dwarf and early varieties of kafir and milo produced during the past season, in spite of the intense dryness, 25 to 50 per cent of their normal yield, while the ordinary larger and later varieties made an average of only 10 to 25 per cent of their normal yield.

Further experiments continue to show the great hardiness and earliness of the Chinese or kowliang sorghums. Considerable work has been done through chemical analyses and milling and baking experiments to determine the probable food value of several kinds of grain sorghum.

RICE INVESTIGATIONS.—Experiments were started this year in South Carolina to determine the best means of controlling rice blast ("rotten-neck") by preventive measures.

During the summer experiments were also begun in Florida to determine the possibility of growing rice on the land lying between the Everglades and the ocean. Portions of this area during the winter months are profitably used in trucking, but are too wet in summer and early autumn to grow on a commercial scale any other crop than rice.

Experiments in California were conducted on three types of soil covering a large area in the Sacramento Valley. Two years' results indicate the possibility of growing rice in that region on a commercial scale, the important thing now being to determine the varieties best adapted to the region.

Interesting results are being obtained in the rice investigations in Louisiana and Texas. In the former State special attention has been given to the eradication of red rice, with some results that are encouraging.

OAT INVESTIGATIONS.—Some very promising pedigree strains of spring oats have now been produced in sufficient quantities to be grown in field tests for the first time.

Considerable progress has been made in the selection of hardy winter strains, a number now being grown on the Arlington Experimental Farm which have developed a considerably greater degree of hardiness than ordinary winter oats. This year several of these strains weighed from 34 to 36 pounds to the measured bushel.

The value of the varieties of oats introduced by this Department was further shown this year. The Swedish Select is now one of the leading varieties in the Northern States, the production in Wisconsin alone being estimated by authorities in that State at 45 or 50 million bushels. The Sixty-Day, another of the Department's introductions, is fast becoming the most popular oat in the corn belt.

BARLEY INVESTIGATIONS.—Of the barley varieties introduced by the Department, the Gatami, from Manchuria, promises, after several years' trial, to be of much importance. It ripens from one week to ten days earlier than other six-rowed varieties now grown in the Northwest and also yields better than many of these varieties.

A method of selecting seed barley has been devised by taking advantage of the varying specific gravity of different cereals and other seeds and of seeds of the same cereal in different conditions, and a circular on the subject has been published.

The attempt to produce a true awnless variety of winter barley was finally successful, it having resulted from a cross of Tennessee Winter barley, a six-rowed variety, and Black Arabian, a two-rowed black barley. This new barley is quite distinct from the old so-called beardless barley, being a true awnless variety, and it appears to be very prolific.

Another result from the same cross is the fixation of a new hooded barley which ripens one week earlier than other hooded varieties.

Cereal-disease work.—The great damage that continues to be done to cereal crops by rusts has been the incentive to give these diseases much further attention, and during the year a bulletin has been published giving considerable new information, particularly with regard to the manner of living over from year to year, the important relation of the weather to rust epidemics, and methods of securing varieties of grain resistant to rusts. Breeding grains for rust resistance has been continued.

Preliminary experiments have been made with cresol for the prevention of smuts, the results of which indicate that this substance may become an important fungicide for use with stinking smut of wheat and smut of oats. There is promise, also, that the modified hot-water treatment for loose smut may be further simplified, thus making it easier of application.

Preventive measures for sorghum smuts have been improved upon, and results of investigations have been published.

Investigations in the Southern States.—During the past year there has been a striking increase of interest in grain cultivation in the South, no doubt partly due to the increased attention being paid to diversification of crops and partly to the increased price of wheat and other cereals. It is hoped that special attention may be given during the coming year to such questions and that much more help may be given to farmers than has formerly been possible.

CORN INVESTIGATIONS.

The corn work has been of greater value and of greater interest than in any other year. It has brought out the possibilities of the crop, which is already by far the most valuable one of the country, but which, when better understood and better cared for, will more than double its value.

The breeding of early maturing varieties of corn for the Northern States and the greater interest in corn growing in the Southern States are rapidly increasing the acreage planted to this crop. The acreage in 1909, greater than that of any previous year, was 5 per cent less than that of 1910. The tests of the last two years show that the rich delta lands of the Mississippi River are well adapted to corn growing, and conditions there are such that the crop can be harvested and shipped advantageously and in a drier condition than northern-grown corn.

The production last year of 100 bushels of corn per acre on large tracts and over 200 bushels on contest acres in States that average 25 bushels or less to the acre is sufficient argument in favor of more intensive corn culture.

The past year has marked a great improvement in regard to corn contests. Competitors generally have come to realize that he is the most successful who produces good corn most profitably without

injury to his land. It is gratifying to note that awards for highest and most profitable yields are taking the place of awards for most uniform and most beautiful ears.

TOBACCO INVESTIGATIONS.

The tobacco investigations have included work with most of the principal cigar, manufacturing, and export types, covering ten of the leading tobacco-growing States. In addition to special problems in harvesting, curing, fermentation, and the control of diseases, there are three broad problems in tobacco culture which have received special attention, namely, the production of improved types by breeding and selection, the determination of the best use of fertilizers, and the development of systems of crop rotation best adapted to the production of tobacco from the standpoint of both quality and yield.

In the Broadleaf belt of the Connecticut Valley it has been shown that the use of phosphates more readily available than those ordinarily applied by growers gives a marked increase in the yield of tobacco. Further experiments in the steam sterilization of seed beds indicate that in addition to destroying weed seeds and fungous diseases this treatment reduces the injury from the mosaic or calico disease, one of the most widespread troubles affecting any crop plant. The value of the system devised by the Department of introducing artificial heat into the curing shed has been clearly demonstrated, particularly in connection with the new method of harvesting by picking the leaves from the stalk, which is rapidly coming into use in the Connecticut Valley.

In New York the Haynes type of tobacco as improved by careful selection is rapidly supplanting other varieties grown for filler purposes. In Ohio new types have been secured by five or six years' systematic breeding which are more productive than the ordinary Zimmer and Seedleaf varieties, and these are being grown commercially this season for the first time. Similar work has been carried on in Pennsylvania during the year, and a Farmers' Bulletin outlining practical methods of growing tobacco in the State, with suggestions for their improvement, has been issued.

In the export and manufacturing districts of Maryland and Virginia, experiments and demonstrations in the best use of fertilizers and systems of crop rotation especially adapted to tobacco culture have been continued. The development of improved types and strains by breeding and selection and row-to-row variety tests has received much attention. In Maryland a variety developed from a cross between Connecticut Broadleaf and a native Maryland tobacco is showing marked superiority in yield and size and is giving satisfaction in the hands of a number of farmers. In Virginia local stations have been maintained in the principal tobacco districts.

A problem of vital importance to the tobacco industry of the so-called "old belt" of North Carolina, more particularly in Granville County, is the control of the Granville wilt. This problem has been taken up from the standpoints of breeding resistant varieties and of developing systems of rotation, fertilization, and cultivation which will control the disease. In the "new belt" of eastern North Carolina and South Carolina much complaint is heard from the trade as to the poor burning qualities of the tobacco, and this matter is now being investigated, mainly from the standpoint of improving the formulas of the commercial fertilizers now used.

In connection with the fertilizer experiments in the various tobacco districts, tests are being made of the efficiency of some of the new commercial sources of nitrogen, more particularly calcium cyanamid and also of ammonium sulphate, for the various types of tobacco. These tests are of special importance because of the high cost of such standard nitrogenous tobacco fertilizers as cotton-seed meal.

DRY-LAND AGRICULTURE INVESTIGATIONS.

The results of the investigations in crop rotations and cultivation methods in the Great Plains region east of the Rocky Mountains and west of the ninety-eighth meridian have been of unusual value and interest during the past season. Drought, more or less severe, has been experienced from Montana and North Dakota to Texas. At Williston and at Edgeley, N. Dak., the conditions were so severe that all crops were practical failures, although the most approved methods of moisture conservation were used on some of the plats; but even here many valuable lessons were learned, and if the drought had been less prolonged very remarkable differences would have been observed in the yields due to different methods of cultivation and crop rotation. This brings out very strongly these two important facts: (1) No system has yet been devised that will insure crops during periods of as severe drought as sometimes occur in this region, and (2) properly planned and executed rotations and tillage methods will greatly reduce the loss by droughts of only moderate severity, such as frequently occur here. These same methods will also increase the yields and net profits during favorable years. In Texas, Kansas, Colorado, Nebraska, and Montana the drought was less severe. At the stations in those States the results obtained from the various methods employed were unusually uniform and consistent, not only when station is compared with station during the past season, but also when comparisons are made between different grains. These results are also in a general way remarkably consistent with those of previous years.

The experimental farms established and managed by the Office of Dry-Land Agriculture are proving of great value for carrying on

cooperative work with other offices of the Bureau of Plant Industry, with other Bureaus of the Department, and with the state experiment stations. This cooperative work should be still further extended, developed, and systematized, particularly along the lines of plant nutrition and soil bacteriology. The establishment of a permanent and profitable agriculture in the immense area known as the Great Plains is an undertaking of such magnitude and economic importance as to demand the very best cooperative efforts of both state and Federal agencies, and this cooperation is being effected in a most efficient manner by this Department.

The main points established by the investigations up to the present time are as follows: (1) Crop rotations calculated to conserve the organic matter as well as the moisture in the soil are the main dependence to guard against loss from deficient rainfall. (2) The effects of rotations are cumulative, and these investigations must be conducted systematically through a long term of years and at many stations in order to establish a safe basis for a permanent agriculture.

PHYSICAL INVESTIGATIONS.

Physical measurements are being made at all of the dry-land experimental farms to determine the methods of cultivation which are most effective in conserving soil moisture and the amount of water required by the different crops. It has been found that the evaporation from a freely exposed tank of water is the best criterion of the water requirements of a crop, as this gives the combined effect of temperature, humidity, and wind. The evaporation has been shown to vary greatly in different dry-farming sections, being nearly twice as great in northern Texas as in North Dakota. A higher rainfall is consequently necessary in regions of high evaporation. This is a subject which every prospective settler in dry-farming regions should study carefully, and will be found fully discussed in a recent publication of the Department.

PROGRESS OF WORK AT FIELD STATIONS ON RECLAMATION PROJECTS.

The Department is now operating field stations on the following reclamation projects in the Western States: Yuma (Arizona-California), Truckee-Carson (Nevada), Umatilla (Oregon), Klamath (Oregon), Huntley (Montana), North Platte (Nebraska), Williston (North Dakota), and Bellefourche (South Dakota). Among the more important features of the work are the testing of newly introduced varieties of crop plants, plant breeding, investigations in plant nutrition, experiments in the utilization of native forage and fruit plants, and experiments in tillage methods and crop rotations.

At the Yuma Project particular attention has been given to experiments in growing Egyptian cotton. It has been demonstrated that this type of cotton, characterized by the superior length, strength,

and fineness of fiber, gives large yields and produces lint pronounced by American spinners equal to corresponding grades of imported Egyptian cotton.

The plant-nutrition problems offered by certain peculiar soil types of the Truckee-Carson Project are being chiefly investigated. Cooperative work by bacteriologists and physiologists of the Department looking to the correction of these unfavorable conditions is in progress. Experiments with orchard and small fruits seem to indicate that owing to the likelihood of late spring frosts in the valley bottoms the higher lands offer the best prospects of success. Alfalfa, the cereals, and sugar beets appear to be the most promising crops for the lowlands.

The Umatilla Project appears to be adapted to orchard fruits, grapes, and small fruits, such as strawberries. These crops are therefore receiving special attention on the experiment farm.

On the Klamath, Huntley, Williston, and North Platte projects experiments were begun last year with the crops that appear to be best adapted to the respective local conditions. It is as yet too early to report results. On the Bellefourche Project water for irrigation has not so far been available on the experiment farm, and the work has been confined to dry-land agriculture experiments on that portion of the farm lying above the ditch.

On several of these projects most of the settlers are unfamiliar with irrigation, and instruction and demonstration of methods of applying water is proving to be an important part of the work.

ALKALI AND DROUGHT RESISTANT PLANT-BREEDING INVESTIGATIONS.

The Department is engaged in extensive tests of crop varieties in order to ascertain which ones are most resistant to drought, and is seeking to secure increased resistance by plant-breeding methods.

Some of the problems which are being studied are: (1) Ability to adjust growth to available moisture, as varieties of grain crops, for example, that make a limited stem and leaf growth withdraw less moisture from the soil early in the season and have a better chance to ripen seed than do ranker growing, freely stooling varieties; (2) character of the root systems, whether extensive and shallow, permitting the fullest possible utilization of light rains, or deeply penetrating, thus tapping supplies of moisture at greater depths in the soil; (3) conservation of water by reducing transpiration or, in other words, increased economy in the use of water; and (4) avoidance of drought by maturing early before extremely dry weather begins or tolerance of drought through ability to arrest growth during dry periods, resuming development whenever a rainfall brings sufficient moisture.

In the arid and semiarid regions thousands of acres of hitherto untilled land are being taken up by farmers. As a rule the newcomer

is unable to estimate closely the capabilities of the land until it has been put into crops. During the past three years correlations between the different types of native plant covers and the conditions influencing crop production have been worked out in portions of the Great Plains area, and these have made it possible to judge from the character of the natural vegetation the adaptability of the land for different crops.

The plant-breeding work with Egyptian cotton in the Southwest has resulted in the development of two new and distinct varieties quite different in the characters of the plants and fiber from the Mit Afifi stock with which the work was begun. The new types are distinguished by the large size of the bolls and the fineness and great strength of the lint, which averages in both varieties about $1\frac{3}{8}$ inches long. One of them has already been tested on a field scale at several localities in Arizona and southern California, and has proved very satisfactory in yield and in the uniformity of the product. Strains have also been secured by selection which possess the characteristics of the Mit Afifi variety, but are greatly superior to the average of that variety as grown from imported seed in productiveness, size of bolls, and quality of fiber. The different types of fiber produced by these varieties are well adapted to most of the uses to which the $12,000,000 worth of cotton imported from Egypt in 1909 was put by American spinners. In view of the prevailing high prices of long-staple cotton and the insufficiency of the present supply, it is hoped that the growing of Egyptian types of cotton will soon be taken up on a commercial scale in the Southwest.

THE RESEEDING OF DENUDED MOUNTAIN GRAZING LANDS.

It is clear from the season's study that acidity of the soil is a factor of the greatest importance, hitherto unconsidered, in the seeding of these mountain grazing lands. Hereafter experimental sowings will be made with reference to conditions of acidity as well as those of temperature and moisture.

As there are certain wild plants which grow only on acid lands and others which grow only on neutral or alkaline lands, the presence or absence of these indicative plants is an excellent practical guide for field work. The most trustworthy indicators of acidity are various plants of the blueberry and heather families, especially the species of the genus Vaccinium known in New England as blueberries but in the region of most of the National Forests called huckleberries.

TRUCK-CROP INVESTIGATIONS.

The efforts which have been made to develop and maintain strains and varieties of the standard commercial vegetables peculiarly adapted for specific purposes have proved decidedly successful.

The crops now well in hand are lettuce, cauliflower, cabbage, beets, and tomatoes. Others will be taken up as rapidly as possible.

The Arlington Farm, which is the Department's field laboratory in plant industry, has developed into the most intensive enterprise of this character in America. The investigations under way at the farm are larger and more varied than those upon any similar farm in the United States. During the year the crop-improvement work alone involved the testing of more than 2,000 samples of forage crops, 7,000 samples of cereals, 1,500 samples of vegetables, 25,000 samples of potatoes, and 250 drug plants. The fruit plantations consist of over 500 sorts of apples and more than 300 varieties of peaches, and the shrubbery and ornamental trees now include 240 distinct varieties and species.

FRUIT INVESTIGATIONS.

From the citrange-orange crosses it is hoped to obtain fruits nearly if not quite equal in quality to the varieties of oranges now grown and at the same time possessing greater hardiness, enabling them to resist the occasional severe freezes which cause so much damage in the orange districts.

DATE CULTURE.—The successful ripening at the Department gardens in Arizona and California of many of the best types of dates has led to a greatly increased interest in the possibilities of commercial date culture in this country. Because of the great cost of establishing a date orchard the Department has followed the policy of introducing and testing at its own gardens in advance of general distribution the best varieties of dates from the Old-World deserts, so that growers may be accurately advised as to the varieties most likely to succeed in specific localities. At the same time, in order to familiarize growers with the cultivation and care of the trees and the harvesting of the fruit, many thousands of seeds of the best varieties of dates have been distributed. New methods of propagation are being worked out to permit of the rapid dissemination of these new varieties in the regions to which they are adapted.

FIG CULTURE.—The United States now produces annually only about 200 tons of Smyrna figs, while 2,000 tons of that type are imported.

The finest types of the Smyrna fig are produced in the Meander Valley in Asia Minor. Investigations have shown that in California the foothills of the Sierra Nevada Mountains bordering on the San Joaquin and Sacramento valleys on the east form just such a region as the Meander Valley, though vastly larger in extent. It is confidently believed that somewhere in this warm foothill belt will be found the best fig region in this country. In order to demonstrate this at as early a date as possible, the Department leased a seedling-fig orchard at Loomis, Cal., situated some 400 feet above the valley

floor. This orchard was planted some twenty-five years ago with seed of the best Smyrna figs. About half of the seedlings produced there are good edible varieties, the other half being caprifigs. From this collection the Department has distributed to growers in the foothills and cool coastal valleys a special collection of Smyrna figs, with appropriate caprifigs. It is believed that within three years it will be possible to determine definitely the localities best suited to the production of figs of the highest quality.

STUDIES IN BLUEBERRY CULTURE.

In the annual reports for 1908 and 1909 reference was made to experiments on the domestication of the blueberry. A publication has since been issued describing the principles of culture of these peculiar plants and showing the reasons for failure in most of the early attempts to grow them. The propagation of selected plants by cuttings and other methods has also been accomplished, and there is every prospect that effective methods of field culture will be developed and that selected varieties having fruits of large size and other desirable qualities can be grown. Experiments are now in progress with a variety bearing berries more than half an inch in diameter.

FIELD INVESTIGATIONS IN POMOLOGY.

Fruit marketing, transportation, and storage investigations.—These investigations have related primarily to the handling of table grapes, lemons, and apples in California, oranges in Florida, and peaches in Georgia, the object being to ascertain the causes of loss through decay of fruit in transit; to determine methods of handling it which will reduce the loss to a minimum; and to secure information relative to the proper methods of caring for it prior to and during storage. In the transportation work in California and Florida, the behavior in transit of grapes, lemons, and oranges handled under the prevailing commercial conditions was contrasted with fruit so carefully handled that injury to individual fruits was reduced to a minimum. The results in practically every case emphasized the fact that loss in general is proportionate to the amount of injury that the fruit receives prior to or during packing.

The special peach problem considered in Georgia was the influence during and after transit of cooling the fruit to a relatively low temperature before shipping. Rather marked results favoring such treatment were obtained.

In connection with the transportation tests made under different conditions, a large number of supplementary experiments, including the effect of washing lemons, were conducted in various packing houses.

In 46 experiments with lemons in 15 California packing houses in 1910, commercially handled washed fruit developed the greatest

amount of blue mold, commercially handled fruit not washed ranked second, carefully handled lemons third, while carefully handled unwashed lemons developed the least injury.

The results of the experimental shipments of lemons from California to Washington, D. C., contrasting the behavior of carefully graded and packed fruit with fruit handled under commercial conditions, show that less than one-half as much blue mold developed in the former as in the latter.

There is a wide difference in the amount of decay in fruit shipped by packing houses employing different methods of handling the fruit. Lemons packed in California by eight packing houses where careful methods prevailed developed less than one-tenth as much blue mold as fruit packed by eight houses under careless conditions.

Considerable demonstrational and instructional work has been done incidentally by the men engaged in these investigations, resulting in one locality in Florida in less than one-fourth as much decay after as before instruction.

Storage investigations were carried on in California with grapes, lemons, and apples. Different problems were involved with each of these fruits. The results indicate that the present market season of grapes may be materially extended if the fruit is packed in a "filler" before storing. Redwood sawdust has proved the most effective material thus far tried; but its use is attended with some objectionable features, owing to the very fine dust particles adhering to the fruit. The investigations further showed that 40° F. is the minimum temperature at which lemons should be stored, with a possibility of better results at an even higher temperature, and that "internal browning" in storage of apples grown in the Pajaro Valley is less serious in fruit stored at 35° than at 32° F. It is still less at a temperature of 37° F.; but the ripening processes are too active at this temperature for satisfactory results otherwise. The fruit stored at 32° F. possessed the best external appearance.

VITICULTURAL INVESTIGATIONS.—The eleven experimental vineyards established in different sections of California are now yielding important results with regard to varietal adaptations to different soil types and diverse climatic conditions, congeniality of Vinifera varieties on resistant stocks, and the value of a large number of direct producers.

Material progress has been made in the investigation of the Rotundifolia group of grapes, especially with regard to varieties and methods of pruning and training.

Investigations in the Middle Atlantic States have demonstrated that with the application of proper methods grape culture in this region may again be made as successful as it was in former years.

FRUIT-DISTRICT INVESTIGATIONS.—In connection with the fruit-district work the study of the adaptability of fruit varieties to the

Ozark region has been completed during the past year and considerably extended in certain sections of Oklahoma, Kansas, Nebraska, and the central and southern Great Plains area.

GREENHOUSES, GARDENS AND GROUNDS.

The gardens and grounds of the Department have continued under the care of the Bureau of Plant Industry. A gradual readjustment of the grounds to meet the changes incident to the erection of new buildings and the removal of older structures has been made. The greenhouse equipment has been somewhat enlarged and now affords increased facilities for pathological work and for plant quarantine, which have been very much needed in connection with the research work of the Bureau. The removal of the last of the old greenhouses has resulted in marked improvement of the appearance of the Department grounds.

PROGRESS IN PLANT INTRODUCTION.

The possibilities which lie in the introduction of the wild relatives of cultivated plants and in the breeding of them with well-known domesticated forms have become apparent to a wide circle of official and private experimenters throughout the country. In order to meet the demand for these wild plants, which in themselves are little more than curiosities, a world search is being carried on by hundreds of correspondents of the Office of Foreign Seed and Plant Introduction. The time required to secure and place in the hands of an experimenter some foreign species of plant which he wishes to hybridize is rapidly being reduced to a negligible quantity, and the stimulus afforded in the creation of new varieties suited to peculiar local conditions is of great and lasting benefit.

The search which was made in northern China three years ago for the original wild peach resulted in the discovery of a new form of peach (*Amygdalus davidiana*) which for hardiness in Iowa, at least, exceeds anything yet grown there. There are two strains, and both have proved much hardier than the peaches grown at this limit of the peach belt. At the same time this Chinese peach, which is used by the Celestials as a stock on which to graft all of their stone fruits, bids fair to prove a drought-resistant stock for the peach growers of the Southwest. Extensive experiments are under way to test more thoroughly this important stock for stone fruits.

Ten acres of Japanese timber bamboo are now growing at Brooksville, Fla., as a result of the introduction of more than 3,000 young plants from Japan, while a similar but smaller area is located at Avery Island, La. This is the first serious attempt in this country to test on a commercial scale the culture of a plant which in the Orient forms one of the best paying crops.

The mango industry of Florida and Porto Rico has reached a stage when the demand for grafted plants of imported varieties is much greater than can be supplied by the Department, and several thousand seeds have been ordered for propagation purposes. One single tree of an imported variety produced this season 428 fruits, and the fancy-fruit dealers of New York have pronounced these imported mangos worthy of commanding the highest prices.

The unusual interest attached to the discovery of the wild drought-resistant wheat in Palestine mentioned in the last report made it advisable to send an expert in acclimatization to inspect on the slopes of Mount Hermon this new prototype of the great cultivated cereal and secure data and material which will aid in the future study of its possibilities for dry-land conditions. This investigation is still in progress.

An agricultural explorer of the Department has spent the year exploring the plant resources of southwestern Asia and, although meeting with many unexpected difficulties, has pushed his way into Chinese Turkestan. Among the large number of interesting things he has secured is a variety of alfalfa from Erivan which is said to be longer lived than the Turkestan variety experimented with in the Caucasus; a species of Medicago from an altitude of over 4,000 feet, which is already being utilized in the work of creating new hybrid alfalfas for the Northwest; a wild almond from the Zarafshan Valley, found growing on the dry mountain sides at an altitude of 6,000 feet, which may prove to be a desirable stock for stone fruits; a drought-resistant cherry for home gardens in the Northwest and for use as a dwarfing stock, from the mountains near Samarkand; a collection of apricots with sweet kernels from the same region; the Afghasian apple and special varieties of pears for trial in the Gulf States; some remarkably hardy olives which have withstood zero temperatures and still borne good crops of fruit; late and early varieties of Caucasian peaches for trial in the Southwest; seeds collected in the Caucasus from wild plants of the true Paradise apple, which is used as a dwarfing stock, for the purpose of obtaining seedlings not infested with crown-gall; scions of a newly produced crab apple, reported to be a better keeper than American crab apples; the Slew Abrikose, a variety of apricot with a skin as smooth as that of a nectarine; seed of the Karakatch tree, a Turkestan elm, for the hot, dry sections of the United States; a remarkable drought-resistant poplar for the Middle West; a wild strawberry, fruiting at the end of February on the dry calcareous cliffs of the Caucasus, of possible use to strawberry breeders; a collection of hardy table-grape varieties from the Caucasus, some of which are reported to possess very unusual keeping qualities; and varieties of Asia Minor wheat and a collection of cereals from the oases of Samarkand, Old Bokhara, and Merv.

Two tons of roots of the edible aroids were harvested in South Carolina as a result of an experiment with these wet-land root crops, which seem to thrive well where the potato can be grown only with difficulty, and a much more extensive experiment in the growing and marketing of these important crops is under way.

The hardy yellow-flowered alfalfas which were obtained from central Asia have already been crossed with the hardiest of the blue-flowered forms, and the resulting crosses have proved their unusual hardiness and are now being investigated to determine their value to the farmers of the Northwest.

The popularity of a newly introduced Japanese salad plant and vegetable called udo has reached the stage when one of the largest asparagus growers in the country contemplates testing it on a considerable scale with a view to placing it on the market.

The fruiting at various points in the Southern States of the Chinese wood-oil tree, from the nuts of which the best drying oil is expressed, has made it advisable to set out in Louisiana a test orchard of an acre to determine its commercial possibilities.

The call for young trees of the seedless Chinese persimmon which was fruited in North Carolina last year was so great that special arrangements for the propagation of this variety had to be made, one firm desiring to put in 10 acres of this new sort even before it was fully tested by the experts of the Department.

The imported large-fruited jujubes, which form a very important orchard industry in China, the preserved fruits comparing favorably with dates, have shown themselves adapted to the arid climate of the Southwest, and extensive trials will be undertaken in California and in Texas.

INVESTIGATIONS IN FARM MANAGEMENT.

The Department has continued its study of the methods and practices of successful farmers, giving special attention to those types of farming which have maintained productiveness over a long period of years. At the same time it has been carrying to the farmer in a practical way many of the scientific facts brought out in its research investigations. Much of the demonstration work is being carried on in close cooperation with the state agricultural colleges and experiment stations.

Southern farm management.—In the farm-management demonstration work in the Southern States emphasis has been placed on the importance of winter legumes as a means of putting humus into the soil and preventing leaching and soil washing and as hay crops in a more diversified type of farming. A phase of this work is the teaching of farmers to grow their own supply of seed of these legumes. In certain parts of the South, where the area of cotton has been cut

down because of the ravages of the boll weevil, farmers have been encouraged to grow soy beans as a possible substitute for cotton seed in the production of oil. The same machines that are used for extracting cotton-seed oil can be employed for extracting the oil from soy beans. The vines and the cake residue are also valuable stock feeds. Cropping systems have been devised for southern farmers entering upon some kind of live-stock farming. Many of the industrial schools of the South are giving attention to farming. The Department is cooperating with these institutions in devising plans of management which shall teach correct principles of crop rotation, tillage, and fertilizing.

Northern farm management.—In addition to the study of farm practice throughout the Northern States, the attempt has been made to assist individual farmers, where located in typical sections, in planning their farm operations. In Maine personal work in demonstrating the method and value of the home mixing of commercial fertilizers was taken up with more than 1,200 farmers. It has been shown that good crops of potatoes, clover, and corn can be grown on some of the agriculturally abandoned hill lands of southern New York if attention is given to better strains of seed, more thorough tillage, and in many instances the use of lime. In northern Michigan, Wisconsin, and Minnesota are extensive areas of comparatively cheap cut-over hardwood and pine lands, varying greatly in quality and requiring distinctly varying types of farming for the greatest success. These types are being worked out and vary from dairying and hay farming on the heavier soils to the growing of seed crops, such as clover, hairy vetch, and rye, on the lighter soils. An agricultural survey of Iowa, showing the types of farming prevailing in each section of the State and the main agricultural problems needing attention, has been completed. In Missouri a farm-management organization of 200 farmers from all over the State is attempting to revise the systems of farming there along improved lines suggested by the Department.

Western farm management.—Nowhere is the study of farm experience of greater importance than in the West, where farming is different from anywhere else in the United States. Each farm is in a sense an experiment station, and the experiences of the individual farmers are of great importance in formulating wise plans of farming. Satisfactory cropping systems and farm methods have been worked out for parts of western Kansas, Nebraska, and eastern Colorado. The recommendations of the Bureau on tillage practices in the upper Columbia River Basin have been widely adopted.

Farm organization and operation.—The man and labor hours required to grow farm crops and do all kinds of farm work are being studied in detail on more than 100 farms. The records thus secured

show just what it costs to produce a quart of milk, a bushel of corn, a colt of definite age, and the like. These data will later become the basis for determining the profits of various farm enterprises under widely varying conditions. In New Hampshire a farm-to-farm survey of four townships was made to study the relation of profits to the type of farming followed. The results bring out strongly the important places occupied by fruit and poultry on the farm. Studies have been made of farm investments and of the details of machinery and tools required in different types of farming. It has been found that usually only about one-half the capital invested in farming is in the land, the remainder being in building equipment, tools, and live stock. Not infrequently men buying farms put all their money into the land and then struggle for years with inadequate working capital to make a living, whereas if a judicious division of the investment at the outset had been made a much more productive and profitable plant would have resulted.

PRICKLY-PEAR INVESTIGATIONS.—The past severe winter has shown that the spineless forms of prickly pear must be confined to regions even farther south than was previously announced. This is particularly true in the regions from Texas to Florida. Investigations indicate, contrary to general belief, that prickly pears breed true to seed. The spiny species native to southern Texas are giving great promise as a cultivated farm crop. Thousands of cattle have been "roughed" through on this feed the past year, and several dairies have depended on it alone for their roughage. Both dairy cows and other cattle do well with no other roughage.

WEEDS AND TILLAGE.—Methods of eradicating quack-grass, or witch-grass; perennial morning-glory, or bindweed; and wild onions have been worked out on the basis of their agronomic habits, and extensive demonstrations are in progress to bring these facts home to farmers in different parts of the country. Work on the relation of weeds to the tillage needs of corn is being continued on 160 farms in 32 States. Results of this work to date seem to indicate that the primary object of corn tillage is the destruction of weeds.

FARM PRACTICE.—The possibility of curing hay by artificial drying has been shown to be practicable for regions like the South, where it is difficult to cure hay because of untimely rainfall. A drier that cures green alfalfa in 25 minutes into a very superior hay at a nominal cost has been designed and constructed by the Department. The study of farm practice in the use of commercial fertilizers has resulted in the publication of a Farmers' Bulletin dealing with this subject in the South. Studies of pastures have shown their growing importance in the production of cheap beef. The run-down condition of pastures in many sections is being studied with special reference to their rejuvenation. In the clearing up of logged-off land, promising new

methods for burning stumps which appear to be cheaper than the use of powder and the donkey engine, although slower, have been devised.

FARMERS' COOPERATIVE DEMONSTRATION WORK.

The demonstration work among southern farmers is rapidly increasing. Organized in 1904 for the purpose of fighting the boll weevil in Texas, this work has now extended to all of the Southern States.

The problem of meeting the advance of the weevil in the South is a complex one. Southern farmers for years have raised cotton and depended upon it to furnish home necessities and supplies. A credit system has prevailed under which the cotton farmer, whether owner or tenant, runs twelve months behind. When cotton fails, his credit fails; hence the necessity for a change of methods.

When the boll weevil came, bankers and business men lost confidence and extensive local panics resulted. With his cash crop cut off the necessary food crops for man and stock had to be grown on the farm. It was necessary to teach and demonstrate diversification of crops in order that the farmers might be able to raise cotton at a profit and in sufficient quantities to meet the world's demands, and the Department has undertaken to show how to produce paying crops even where the weevils are numerous.

The leading features of this work are (1) the adaptation of modern cultural methods to the raising of cotton under boll-weevil infestation and (2) the teaching of modern farm methods by which other standard crops can be produced for the purpose of furnishing food for the family and feed for the stock. These things must be done on the farmer's own land and with his cooperation.

From 1904 to 1909 there was an increase from 1 to 362 agents in the field. The number has now reached 450, and the demand for more is urgent. More than 75,000 farmers are receiving direct instruction on their farms. This work has greatly increased the supply of humus and the use of legumes in soils wasted by long-continued cultivation in cotton. It has caused lands to be plowed deeper from year to year and seed beds to be more thoroughly prepared. Cultivation is becoming more intensive, seed selection of both corn and cotton more general, and farming, as a rule, more profitable.

In 1909 figures from a large number of demonstrators showed a comparative increase of from 50 to 400 per cent in the average yield of standard crops, and the figures for 1910 indicate similar results.

One of the striking features of the work of 1909 and 1910 is that in thousands of cases an average crop of cotton has been made in spite of the weevil by following the directions of the Department, whereas others in the same localities who have not carried out these

instructions have failed to make a crop. This is conspicuously true in the alluvial sections of Texas, Louisiana, and Mississippi. The methods advocated are being rapidly adopted by farmers in boll-weevil-infested territory and are fast being recognized as the best means yet presented of raising a crop of cotton in spite of the boll weevil. This means the restoration of confidence and credit and prevents the abandonment of farms and the emigration of labor to other fields.

Private citizens, business men's organizations, bankers' associations, county boards, and others in many of the Southern States have been of considerable assistance to the Department in extending the work.

It has been found by experience that the only way to reach some farmers and to get them to follow better methods of farming is through their boys. Where a farmer's boy has been enlisted in a corn club and produced on his father's farm an acre of corn yielding from 50 to 200 bushels at a cost of not more than 30 cents a bushel, the farmer is no longer skeptical about improved farm methods.

In 1909 there were 10,543 boys enrolled in these clubs. In 1910 the number has increased to 46,225. This feature of the work has aroused unbounded interest and enthusiasm and turned attention toward the farm. Public-spirited citizens in the various Southern States have contributed $40,000 for prizes for these boys. Prize winners in four States were given trips to Washington and awarded diplomas of merit. This year such trips are offered from every Southern State through bankers' associations, boards of trade, educational associations, private citizens, and state fairs. Governors and superintendents of public instruction will give diplomas similar to those earned last year to all boys who make excellent records.

When a boy makes a thorough study of corn it is easier to succeed with other crops. Some of the boys in the boll-weevil parishes of Louisiana have not only broken the records in corn production there but have achieved the same extraordinary results with cotton, potatoes, onions, and other crops.

Marked changes in general farm methods and in the economic life of the people do not take place in a single year. The few demonstrations in each neighborhood the first year attract attention and dispel doubt, the second year brings increasing success, and the third year usually marks the beginning of the general adoption of the changed methods, though time is required to make the adoption universal and thorough in a community.

Special work is done in advance of the weevil to prepare the farmers to meet the new conditions. During the seasons of 1910 and 1911 this effort is being and will be exerted within a few hundred miles of that great semicircular line which marks the boll weevil's

advance, and it is hoped that the panic and business depression usually accompanying the invasion of the weevil will thus be avoided.

PROGRESS IN FORAGE-CROP INVESTIGATIONS.

Breeding improved forage crops.—For most of the farming areas of the country experience and much experimenting have determined the most valuable forage crops. Thus, timothy and red clover are of paramount importance in the northern part of the country and alfalfa in the West, while in the South among the several forage crops used cowpeas are perhaps of highest value. Each of these crops consists of numerous varieties and strains, some of much higher value than others. The isolating of the best strains by selection and the combining of the good features of two or more varieties by hybridizing have already yielded valuable results, and extensive work of this kind is now being prosecuted.

In the case of cowpeas upward of 200 varieties from all parts of the world have been secured and tested. Among those of prime importance to the breeder are the Iron, on account of its disease resistance; the Whippoorwill and New Era, on account of their excellent habits and prolificness; and certain East Indian varieties which are tall and bushy in habit and bear abundant pods with small, hard seeds decidedly resistant to weevil attack. These sorts have been hybridized, and among the progeny are varieties which in excellence of habit, disease resistance, and prolificness combined surpass any of their parents. There is every reason to believe that these improved sorts, which can be readily harvested by machinery, will replace in a large measure those now grown.

In cooperation with the Ohio experiment station the breeding of timothy on an extensive scale has been undertaken at New London, Ohio. The recent introduction and rapid spread of timothy rust have made it necessary to breed for resistance to this disease, as many of the strains previously developed are highly susceptible. It appears that timothy breeding must be in the main comparatively local; at least, strains bred in the East have not proved superior in the West, and vice versa.

Improved alfalfas are mostly needed in the colder States, where great hardiness is essential, and in the Eastern States, where strains that will produce seed under humid conditions and thus become completely adapted are desired. Better seed-producing strains, especially for dry-land farming, are also important. From the progress already made there can be little doubt that all these ideals can be secured. Some of the hybrids between the yellow Siberian alfalfas recently obtained by our agricultural explorers and the hardiest ordinary alfalfas possess excellent habits and great cold resistance, so that the menace of winterkilling is now greatly reduced.

Every year an enormous quantity of alfalfa seed is imported from

Europe, and this has been increasing in recent years. Not only should the United States grow all the alfalfa seed it needs, but a surplus for export should be produced. Splendid yields have been secured by growing alfalfa for seed in cultivated rows on dry lands in the semiarid regions. Strains selected for high seed production have given noteworthy returns in such experiments.

Red clover is a crop of great variability with which little successful breeding work has been accomplished. In the Old World there are several well-defined geographical varieties, none of which, however, have shown superiority in this country over the ordinary American seed. The breeding of this crop presents two types of problems: (1) In the States where ordinary clover succeeds well increased yields can almost certainly be obtained by selecting and breeding individuals which have greater inherent vigor, and (2) in many places it is now difficult to grow red clover on land where it once grew well. This difficulty is commonly referred to as due to "clover-sick" land. The trouble is very obscure, but in some cases is apparently caused by a specific disease and in others by a complex of diseases. In northern Alabama a farmer has grown a selected clover successfully for seventeen years or more on land where ordinary clover failed. This success was obtained by saving the seed of the surviving plants until a strain was established that succeeds perfectly. Apparently this strain differs little from that bred by Professors Bain and Essary, of the Tennessee Agricultural Experiment Station, for resistance to a stem disease which seems to be the principal enemy of clover in that State. The importance of the red-clover crop is such that extensive breeding work of this sort is being prosecuted.

New forage crops.—Many new forage crops from all parts of the world are being tested each year. Only a few of these possess sufficient value to compete with the crops now grown. In a few cases, however, these introductions prove to be of striking value. At least four such plants recently introduced have given such admirable results that there can be little question that they will prove of great value.

Rhodes grass, while not entirely a new grass, has been heretofore tested mainly in the arid regions, where it is not sufficiently hardy to withstand the winters. The experience of the last three years has shown that this grass is especially adapted to the Gulf Coast region, particularly to Florida and southern Texas, where it not only withstands the winter, but grows continuously. In southern Florida three cuttings have been made during the winter months, and as many as six during the entire season. This grass has fine, upright stems and good seed habits, so there is no reason why it may not be employed as extensively as a meadow grass in the region to which it is adapted as timothy is in the North.

Sudan grass is a close relative of Johnson grass, but lacks entirely the rootstocks which make Johnson grass so objectionable as a weed. Sudan grass is a true bunch-grass, after the manner of timothy, and is just as easily handled. It grows taller than ordinary Johnson grass, is very leafy, and produces splendid crops of seed. Depending on the rainfall, it can be cut from two to three times in a season.

Additional experience has verified the high estimate originally placed upon the Yokohama bean. It is really an early velvet bean which will mature its seeds as far north as Virginia and Kentucky and will give all the intervening States a crop as valuable as the Florida velvet bean is in Florida. This variety is unusually fruitful and in the southernmost States will produce two crops of seed in a year. It will doubtless come into extensive use both as a soil-improving crop and for forage. Hybrids between it and the Florida velvet bean and the Lyon bean are of special promise.

During the exceptional drought of the past season in north-central Texas the interesting fact developed that pink kafir is decidedly more drought resistant than milo or Blackhull kafir. Under conditions that caused the latter to "fire" badly, the pink kafir remained perfectly green.

The need of better forage crops is perhaps felt mostly in the semiarid regions. Extended search is still being made throughout Asia in the hope of finding more valuable grasses and legumes adapted to these regions. Some of the legumes from the drier portions of India, like kulthi (*Dolichos biflorus*) and the bonavist (*Dolichos lablab*), have demonstrated their ability to withstand drought under which cowpeas suffer severely, and it is not unlikely that these two plants may come to be largely grown. This will depend mainly on their ability to produce satisfactory crops of seed. Some of the new millets from the interior of Asia, especially the Kursk millet obtained in 1899 and the Turkestan millet secured in 1906, are likely to replace the other varieties. The Kursk millet can be grown as far north as the Canadian line, but the Turkestan is a later variety which matures only in the central and southern portions of the Great Plains region.

CONGRESSIONAL SEED DISTRIBUTION.

The distribution of seeds and plants upon Congressional order has continued along much the same lines as in the preceding year. The demand for vegetable and flower seeds proved greater than ever before. Certain changes in the method of mailing packeted seeds have obviated the necessity for rehandling by the postal authorities in the Washington City post-office, thereby reducing the labor and facilitating the mailing of the seeds. The packeting, assembling, and mailing have been satisfactorily done under contract.

In connection with the seed distribution, an effort to propagate Dutch bulbs successfully has been continued with encouraging results.

Climatic conditions in the Puget Sound region, where the work is being done, appear to be favorable, and it is hoped that a sufficient quantity can eventually be produced to furnish the supply used for Congressional distribution.

FOREST SERVICE.

In my report of last year I estimated the total stand of merchantable timber on the National Forests, exclusive of those in Alaska, at about 400 billion board feet. Revised and more accurate estimates of this stand, obtained during the past year, indicate a total on the Forests of the continental United States of about 530 billion board feet. Though the aggregate is so great it shows a low average stand—under 4,000 board feet per acre. It is true that a considerable acreage of National Forest land lies so high that it will never furnish much merchantable timber, and that much other land is too arid to grow such timber, although it supports a protective cover which must be maintained for the sake of its influence upon water supplies.

The cutting which now takes place does not offset the increase. Even the exceptional fires of the summer of 1910—fires due to such an extraordinary combination of natural conditions—hardly wiped out the increment of the year.

NATURAL AND ARTIFICIAL REFORESTATION.

Where it may be a matter of waiting for centuries if the forest were to be left to accomplish its own return to the areas from which it has been completely dislodged, artificial reforestation must be, and is being, undertaken at once. The work, hitherto mainly experimental, is now entering on what promises to be a practical and successful stage; extensive experimentation must nevertheless be continued, along with practical work where the means of making this a success have been found, in order that the field which lies open may be covered in every part.

Especially encouraging has been the progress made with direct sowing of the Forests. Not only have a large number of methods been given experimental test, but also definite and valuable results have been obtained in some regions. Over 9,000 acres in all were sown during the year, while some planting or sowing was done on practically every National Forest. The work will continue during the present year on a much larger scale.

Reforestation must follow lumbering as well as fire if the Forests are to be both permanent and fully useful. The methods of cutting employed by the Forest Service are always planned with especial reference to bringing about such reproduction as is desired. The natural reforestation which can be obtained through lumbering when the latter is made a means of applying forestry has many advantages over the natural reforestation already described as taking place

on the burned areas of the Forests. Instead of having large areas on which there are no seed trees, careful selection and reservation is made of trees so spaced and situated as to insure ample seed distribution wherever room is opened for new growth. Instead of having a substitution of valueless or inferior trees for those most valuable, the cuttings are planned with reference to removing from the forest, so far as possible, undesirable species.

The work of reforestation is so important that I consider it justifies and demands immediate provision for pushing it forward, and I therefore purpose to ask from Congress an increase of $180,000 in the funds available for it.

The fact that reforestation is to be brought about partly by the actual outlay of money for sowing and planting, partly by permitting the forest to sow itself and protecting the young growth from fire after it has become established, reenforces the statement that National Forest administration means, for one thing, an increase in the investment. Expenditures for artificial reforestation are obviously investments. It is just as obviously immaterial by what methods the new stock is established, so long as it is obtained. Whether hand-sown or tree-sown, if it is growing it represents an increase of capital account. It is worth remembering that only a part of the yearly cost of National Forest administration and protection goes to pay for the transaction of current business. Another part is spent to protect the existing stand of merchantable timber and young growth, while a third part is laid out in providing more material for a future cut through natural and artificial replacement.

PERMANENT IMPROVEMENTS AND FIRE PROTECTION.

For the last four years Congress has made a specific appropriation for the construction and maintenance of permanent improvements on the National Forests. The amount thus appropriated for the year 1910 was $600,000. Of this, something less than $60,000 was spent for maintenance of improvements. The experience of the past summer proved conclusively how valuable these improvements are and how great is the need that they should be multiplied.

During the past season there have been unusually severe forest fires in nearly every part of the country. The National Forests have suffered to a greater extent than at any time since their establishment. When the National Forests were placed under administration, the annual fires were reduced to a small percentage of what previously occurred. In 1906 the fires burned over about 115,000 acres, or about one-tenth of 1 per cent of the total area. In 1909, with a much larger total of Forests, the area burned was 362,014 acres, or something less than two-tenths of 1 per cent of the total. During the past season, under the difficulties of an unprecedented

drought, the protective force was unable to prevent a large number of fires from starting, and many of these could not be extinguished before a great loss had been sustained.

The fires of 1910 were primarily due to a severe drought, which extended throughout the country and which in the Northwest was the most severe ever known, so far as official records show. The spring was very dry, and in the summer, when there are usually abundant rains in the mountains, the rainfall was exceedingly small and very localized. The region most affected was the area drained by the Columbia River, extending from the ocean to western Wyoming and Montana. In most places there was practically no rainfall at all during July and August.

The effect of the drought was to render the forests very inflammable. Not only did the surface litter of leaves, branches, fallen logs, and other material become very dry, but the thick layer of vegetable mold in the deep, usually moist forests became like tinder.

In addition to the drought, the past season was characterized in many places by constant high winds, which rendered fire protection exceptionally difficult. The smallest escaping spark from a camp fire or burning slash pile was often enough to start a blaze, which, under the high winds, developed into a dangerous conflagration in an incredibly short time.

The most severe drought was in the Northwest, and there also were the greatest and most disastrous fires. The worst fires occurred in northwestern Montana and Idaho and in eastern Oregon and Washington. Severe fires occurred in California and the central Rocky Mountain region, but the conditions were not as difficult as in the North Pacific region and the fires were more easily controlled.

In the Northwest the fires began to be numerous in June. During July they increased very rapidly, reaching their climax during the last half of August. The Forest officers were ordered to increase their patrol and use every measure to extinguish the flames. With the increase of the fires, it soon became apparent that the special fund appropriated by Congress was entirely inadequate to meet the situation. Numerous fires were then burning in the Forests and every day new ones were reported. The entire forests of the northern Rocky Mountains were at one time threatened with destruction. Unless the fires had been checked scores of towns and communities would have been wiped out and the lives and homes of thousands of people imperiled. I was confronted with the problem of either putting out the fires or being directly responsible for what would have been one of the worst disasters in the history of the country. Without hesitation I called upon the Forest officers to stop the fires and to make such expenditures as seemed absolutely necessary to accomplish this result. Every source of help was called in. Temporary labor was employed

where it could be secured. The War Department aided by sending troops. The railroad companies, lumber companies, and private individuals cooperated in the endeavor to avert a great disaster.

Early in September the flames were finally subdued. The fires which could be reached by roads and trails were largely put out through the crews working under the Forest officers. Those fires in the inaccessible areas were extinguished finally by the aid of timely rain and snow storms. While the aggregate loss of life and property was large and the cost of fighting the fires about a million dollars, I do not hesitate to state that if it had not been for the heroic and efficient work of the Forest officers, many millions of dollars' worth of public and private property would have been destroyed, and probably many lives would have been lost. I can not commend too highly the self-sacrificing work of the local Forest officers, who toiled day and night, week after week, risking their lives to save the Forests.

The reports show that there were over 4,000 fires in the National Forests during the season. Most of them were small and were promptly extinguished by the Forest officers. Only about 15 per cent of the fires were responsible for the great losses. These occurred chiefly in the inaccessible regions where they could not be reached quickly because of the lack of roads and trails, or in areas inadequately patrolled. The greatest damage was done by the great fire of August 20 in northern Idaho. Many fires were burning at that time, but nearly all of them were under control, and would shortly have been extinguished had it not been for a terrific hurricane which developed and swept all fires beyond control. Within twenty-four hours there was practically a continuous fire for a distance of over 100 miles.

The total area burned over during the season amounts to over 3,000,000 acres. While accurate data have not yet been received from all the Forests, it is probable that between 6 and 7 billion feet of timber was killed. A portion of this can still be cut and utilized, so that it will not be a total loss. The damage in money can not be accurately estimated until forest surveys are made, but it will probably reach over $25,000,000 if both merchantable timber and young growth are considered.

The cost of fighting the fires will aggregate a little over a million dollars. This is a large sum, but it represents considerably less than 1 per cent of the value of the property saved.

It is to be deeply regretted that there was a large loss of life through these fires. Altogether 76 persons in the employ of the Forest Service were killed in fighting the fires. All of these men were temporary employees. That more were not killed was due to the skill and coolness of the forest rangers. Where relatives were found, the bodies were brought out and every help possible given to the families. There were 35 persons killed whose relatives could not be located.

There were a number of men injured more or less seriously. Unfortunately the law does not permit paying the expenses of the injured or their wages after they ceased their work. The hospital expenses of these men were met by private subscription. The Red Cross contributed $1,000. The remaining expenses, including expenses of interment of the dead, were borne by subscriptions from the Forest officers and other members of the Forest Service.

The chief causes of the fires are locomotives, lightning, carelessness in burning slashings, and incendiarism.

Railroads continue to be responsible for a large number of fires. This will continue to be the case until the locomotives are either equipped with efficient spark arresters or oil is used for fuel. It should be said, however, to the credit of the railroads, that during the past season many of them have taken an active part in assisting in the work of fire protection and fire fighting. The Chicago, Milwaukee and Puget Sound Railroad has installed oil-burning locomotives, and it is a striking fact that not a single fire has started from them, although the road traverses a long distance in the National Forests. A number of railroad companies have entered into cooperative agreements with the Forest Service to clear fire lines along the right of way and to employ special guards to patrol the tracks during the dangerous season. The effectiveness of the cooperative patrol by the railroads and the Forest Service was well illustrated in Montana and Idaho. Although a very large number of fires were started, most of them were extinguished before great damage was done. In some instances, however, no effective system of protection had been undertaken and very damaging fires are chargeable to locomotive sparks.

One of the most prolific sources of fire and one which is uncontrollable is lightning. There are scattered throughout the forest innumerable dead trees and stubs. During the past season there were many electric storms unaccompanied by rain. In nearly every such storm some tree was struck and a fire started. These occurred frequently in very remote and inaccessible places and resulted in fires which were very disastrous because they could not be quickly reached.

Many fires are chargeable to carelessness, especially in leaving camp fires and in burning slashings. A larger patrol service would prevent to some extent carelessness in the use of fire in the woods, but fundamentally there is required a better appreciation on the part of the public of the need of protection from fire.

The most regrettable fact is that there has been a considerable amount of incendiarism. While it is very difficult to prove that a given fire is of incendiary origin, circumstantial evidence has shown that many incendiary fires were started during the past season. The situation has been so serious that I have offered a reward for the conviction of incendiaries.

The first necessity in organizing a forest for protection from fire is to construct roads and trails in order that the different parts of the forest may be accessible both for patrol and for the mobilization of fire fighters. A forest in which there are inadequate means of communication can not be fully protected under any conditions. Without trails it is impossible properly to patrol the forest, and in case a fire is discovered it can not be attacked if there are no means of transporting quickly to it men and fire-fighting equipment. The roads and trails serve also as an aid in attacking fires. The work of constructing roads and trails has been pushed as fast as available funds permitted. There have been so far built about 5,500 miles of roads and 16,000 miles of trails. Yet this is only a beginning when the extent of the Forests is taken into consideration.

In addition to roads and trails it is necessary to construct special fire lines. These are cleared lines through the woods located at critical points to supplement the system of roads and trails for fire protection. They serve both to check fires and also as points from which to fight them. Fire lines are being built as rapidly as possible. The most extensive work has been carried on in southern California, where the protection of the chaparral forests is of great importance in protecting the water supply. Fire lines are also extensively built along railroad rights of way and around lumber operations. The burning of broad fire lines here and there at critical points in open yellow pine forests has been undertaken and will be pushed with vigor.

A second necessity in the organization of the Forest is a proper equipment for the prevention of fires and for fighting such as may be started. The most essential primary equipment is a system of telephone lines connecting ranger headquarters and lookout stations. The purpose of the telephone is to enable rangers and guards to give quick notice of fires and to secure such assistance as is required. There are already many instances where millions of dollars' worth of Government timber has been saved through the use of such telephone lines as have already been built. The total amount so far constructed comprises about 9,200 miles. The Forests are still very meagerly equipped.

The Forests should be equipped also with lookout stations. These are usually located at high points from which it is possible to look over a large area. At these lookout stations there should be at least a small building equipped with a telephone. Frequently where it has not been possible to build telephone lines, the lookout stations are provided with the heliograph and other means for signaling. Where the country is flat, watchtowers are built.

An essential part of the equipment of a forest is a system of properly located and well-equipped ranger stations. Many instances

have occurred during this season where fires which threatened enormous damage were promptly extinguished because there was a ranger stationed within striking distance.

The equipment of the National Forests should comprise also an ample supply of tools and other equipment necessary in fighting fires. A beginning has been made in the establishment of small equipment stations here and there along the roads and trails. These stations consist of small buildings or tool boxes containing such equipment as is necessary. Usually they contain axes, shovels, grub hoes, water buckets, water bags, ropes, etc. In some cases in remote sections there is also a certain quantity of provisions, grain, pack saddles, tents, etc.

In the more remote Forests, where travel must be largely by trail, it is necessary to have available pack horses to transport supplies and equipment. It is exceedingly difficult in most regions to secure horses at short notice. In the case of fire breaking out at a distant point it is necessary not only to transport a crew of fire fighters quickly but also to provide provisions for them. It is desirable, therefore, that the less accessible Forests be provided with pack trains with such equipment as is necessary to meet the requirements.

The danger of the recurrence of such disasters as that of last summer's fires should be reduced to a minimum. Though it was unpreventable under the conditions of the year, the day will come when it would be counted preventable, and when under similar conditions it would generally be prevented. This, however, can not be brought about in a single year, nor in five years. It must be brought about gradually by the upbuilding of a thoroughly organized system of forest management. High organization of this sort can be attained only step by step. It is no more possible under pioneer conditions than is a highly organized private industry. What is demanded now is that each year progress shall be made toward the ideal of completely adequate protection.

This means that each year, for one thing, the existing permanent improvements should be extended. Not to extend them as fast as opportunity is given would be criminal. The Forest Service is powerless to provide them except as means are put at its disposal. Expenditures for equipping the Forests with roads, trails, telephone lines, fire lines, and other improvements can be made only from the permanent improvement fund. In the years 1907 to 1911 Congress made available a total for this purpose of $1,975,000. The amount available in 1910 was $600,000; in the current year it is $275,000. There are now on file carefully considered plans for specific permanent improvements calling for an amount of work which the entire appropriation for the Forest Service last year would hardly have paid for. In view of the facts, I consider it my duty to ask for a substantial increase of the permanent improvement fund.

In every forest there is a certain amount of inflammable material on the ground. Not only is there an accumulation of vegetable matter on the surface of the ground, resulting from the annual fall of leaves, but in the old uncared-for forests there is also a large amount of fallen timber. In the virgin forests which have not been burned this dead timber represents the accumulation of many years. There are, however, many areas which have been burned over in the past and are now littered with trees which were killed by the fires. This dead timber constitutes a great menace to the forest. There is an immense amount of it, and there is no way of disposing of it at once. When timber is cut in the National Forests, the tops are piled and burned in order that there may be no further accumulation of such débris, and in such cuttings also the old material which is found on the ground is disposed of where it is at all practicable. Where it can be disposed of, dead timber is sold or given away to settlers. More than three-fourths of the total free-use cut of last year, which exceeded 100,000,000 feet, was dead timber.

The plan has frequently been suggested of burning over the surface of the ground every year or two in order to prevent the accumulation of inflammable material. The theory of this proposition is that if the surface is burned over early in the spring, before it becomes very dry, the inflammable material will be destroyed and any fire which subsequently may start will do comparatively little damage. Some have even gone so far as to assert that the burning of the forests by the Indians and early settlers was the proper way to protect them. As a matter of fact, these early fires were exceedingly destructive. Not only did they destroy enormous bodies of timber, but they killed young trees and prevented the reproduction of the forest. Moreover, the dead trees now standing and lying on the ground, which resulted directly from these early fires, to-day constitute a great menace to the forest. Any wholesale annual or periodic burning of the surface of the ground will result in putting a stop to forest growth. It is unthinkable that anyone should seriously advocate a system of handling public forests by which there is no provision for a future production of timber. It has been customary in portions of the Southeast to burn over the forests annually or periodically, and the ultimate result, as is already actually illustrated in a great many places, is the final destruction of the forest.

There are certain types of forests where annual or periodic burning of certain specified areas is feasible. An example is the open yellow pine forests of the Southwest. Carefully regulated burning of the surface is practicable in those areas where there is no young growth and the timber is sufficiently old to resist the fire. Most of the National Forests are composed of trees of all ages mingled together by individuals or groups. Annual or periodic burning over the surface

in such forests would inevitably result in the death of the small trees and the prevention of new reproduction. The plan of burning the forest for protection is therefore not applicable in most of the National Forests. If the principle of surface burning is to be used, it is best applied in the open types of forest, to burning broad fire lines located here and there at well selected points. The whole surface should not be burned, but only wide lines about 100 to 200 feet wide. In this way there are firebreaks throughout the forest, and if a fire starts it may then be confined to a small area. The cost of the work is thus reduced and bodies of small growth are saved. Even this work requires a large annual expenditure, far more than is now available for the Department.

As the protection from fire is the most important consideration in the administration of the National Forests, I have requested an increased appropriation for this work. In addition to the increase requested for permanent improvement work, I urge that there be an increase of $120,000 for extra patrol, and that authority be granted to me to draw upon the receipts from the Forests, in case of grave emergency, for fighting fires.

NATIONAL FOREST TIMBER SALE POLICY.

It must always be kept in mind, as I pointed out in my report a year ago, that the National Forests form an investment which has not yet become fully productive. They are valuable chiefly for three great uses—water conservation, the production of forage, and the production of timber. The first use is already well developed, so far as concerns irrigation, though it will have much larger development in the future. But of the available water power on the Forests, estimated to be in the neighborhood of 15,000,000 horsepower, only the most insignificant fraction has as yet been harnessed. The forage-producing power of the Forests is generally utilized now; only in the most inaccessible mountain regions does the forage crop go to waste, and the increase of this resource must take place primarily through such improvement in present methods as will enable the areas now used to support a larger amount of stock than at present, rather than through increases in the grazing area. In striking contrast is the timber crop. Its harvesting is confined to a trifling part of the total. While the stockman occupies the length and breadth of the Forest range, the lumberman is operating only along the edges of the vast bodies of the National Forest timber which the slow centuries have ripened for the ax.

When the Forest Service first took charge of the National Forests, through their transfer from the Department of the Interior on February 1, 1905, in an effort to open them to use, timber sales were everywhere encouraged. Less than 114,000 feet of timber were sold during the fiscal year 1905, at an average stumpage price of 75 cents per thou-

sand. In the fiscal year 1906 the amount sold rose to nearly 300,000 feet and the average stumpage price rose to $1.72 per thousand; while in 1907 the sales exceeded 1,000,000,000 feet, at an average stumpage price of $2.42 per thousand.

Since 1907 the totals of sales have been much smaller—in 1908 not much over one-third of the 1907 sales, in 1909 not much over one-fourth, and in 1910 something over one-half. This reduction was partly the result of the general business depression. The lumber cut of the entire country in 1908 and 1909 was considerably less than in 1907; and, since National Forest timber is on what may be called the fringe of the demand for stumpage, it naturally felt the effect of business disturbance to a much greater degree than did timber in more settled regions. But the reduction in sales was largely the consequence of a perception that, on grounds of broad public economy, the timber-sale policy of 1907 required modification.

Following the fires of last summer an abnormal period may be anticipated. As a result of those fires a great quantity of fire-killed timber is in the Forests. This timber must be utilized speedily if it is not to be a complete loss. It is the part of economy to have it lumbered, even though it has to be sold at a very low price, in order that the resulting product may take the place of what would ordinarily be sawed from green timber. In the regions where fire-killed timber is plentiful the cutting of any other material will so far as possible be suspended. Every effort will be made to find purchasers, large as well as small, and stumpage will be offered on very liberal terms. It is hoped that in this way the general and local markets may be led to absorb a large part of the manufactured product of the fire-killed timber in place of the supplies which would ordinarily be drawn from undamaged private and public holdings.

RANGE MANAGEMENT.

The total of live stock of all kinds which used the National Forest range in 1910 under pay permits fell off 2.75 per cent in comparison with the previous year. This is the first year since regulated grazing began that there has not been an increase. The cause of the drop is to be found in the reduction of available range through eliminations of land found to be better suited to other uses than to forest purposes. Since the lands excluded by these eliminations were relatively low-lying, open, and accessible, they were above the average in the amount of grazing use made of them.

Decided progress was made during the year toward working out methods of more intensive range use, and some of the methods which have been experimentally tested were taken up and applied by stockmen on their own holdings with good results.

Mention should be made also of the need of permanent improvements in the form of drift fences, watering places, and other acces-

sories to the handling of stock, as a means of securing the fullest utilization of the forage crop of the Forests. To a considerable extent it has been found possible to secure such improvements through cooperation of the stockmen. The development of the range to its fullest usefulness requires, however, the investment of public money in permanent improvements just as truly as does the successful guardianship and promotion of use of the timber supply of the Forests.

The receipts from grazing were last year for the first time exceeded by the receipts from timber sales. In future years the present relative position of the receipts from these two sources is not likely to be reversed; on the contrary, from now on the receipts from timber may be expected to gain steadily upon the receipts from grazing.

FOREST PRODUCTS INVESTIGATIONS.

The work of the Forest Service for the public is not confined to applying the best methods of management to the use of the water, timber, and grazing resources of the National Forests. Study is also given, so far as is possible with the small part of the appropriation which can be devoted to work other than administrative, to all problems whose investigation promises to promote economy in the use of all that is produced by our Forests, private as well as public, or to increase their yield of valuable material. The investigations directed to this end comprise both investigations of Forest products and investigations in the field of general forestry.

An event of large importance was the completion and occupancy during the year of the Forest products laboratory provided at Madison, Wis., by the State of Wisconsin for the use of the Forest Service. The securing of this laboratory was brought about by the efforts of the authorities of the University of Wisconsin, in the belief that the advantage to the university of having the products investigative work centered in Madison would well repay the outlay. It is to the advantage of the Forest Service also that its laboratory is in close touch with the staff and work of such an institution as the University of Wisconsin.

The Madison laboratory equipment was furnished by the Government. The new building and the new equipment together provide the most effective plant for research into the problems which underlie the best use of Forest products to be found anywhere in the world. Many of these problems are of a highly technical character and can be attacked successfully only through the possession of such facilities as are now for the first time available. These problems include such matters as the strength and physical properties of the various kinds of woods in commercial use, or of woods which though not yet put to particular uses are inherently suitable for them; methods of

seasoning, preserving, kiln-drying, and otherwise handling woods so as to secure from them the maximum service and a minimum of waste; the manufacture of wood pulp; methods of extracting, by distillation and otherwise, valuable wood products; and methods of utilizing sawmill and other waste, either for the extraction of by-products or for reworking into smaller wood forms.

Because of the opportunity which seems to me to be clearly open for advancing the interests of Forest preservation through the study of methods of getting longer or better service from given classes of material, the invention of improved processes of extracting wood products, and the saving of waste, I desire to provide for an expansion of the investigative work of the Forest Service along these lines, and have included in my estimates of appropriations needed for the year 1912 an increase of $72,000 over the appropriation for the current year to make such an expansion possible. I am confident that practical results are within reach which will richly repay the cost of seeking them.

OTHER INVESTIGATIONS.

In cooperation with various States studies of Forest resources and their industrial employment were continued. Such state cooperative studies have in view, from the standpoint of the State the gathering of data needed to make clear what legislative or administrative course will be in the best interest of the State's economic and industrial welfare, and from the standpoint of the Forest Service an enlarged knowledge of Forest conditions and the methods by which our Forests may be made most useful.

BUREAU OF CHEMISTRY.

COLLECTION AND EXAMINATION OF FOODS AND DRUGS UNDER THE LAW.

The inspection and examination of both imported and domestic foods and drugs have been steadily extended along the lines established in the three preceding years, while at the same time the pressure of court work and the necessity for special investigations increase in even greater proportion as the work develops. The total number of samples analyzed at the 21 food and drug inspection laboratories during the past fiscal year was 19,411; of the 9,571 interstate samples about 40 per cent were reported as illegal. This does not indicate at all the condition of the market, as usually only suspected samples are taken and the inspectors naturally become more expert in this respect as their experience widens. It is, however, an index to the effectiveness of the food control. As a result of 87,265 floor inspections, over half of which were made at the port of New York, 8,217 imported foods were analyzed and about 37 per cent were reported as illegal. By this is meant that they were either adulterated or mis-

branded, and by far the larger number fall in the latter class. In the prosecution of researches in connection with inspection work and in cooperation with other branches of the Government 1,623 miscellaneous samples were analyzed. The desultory examination of imported products received at nonlaboratory ports has now been systematized, which will greatly increase the efficiency of this inspection, the leading ports within the jurisdiction of any branch laboratory being definitely assigned thereto. Invoices may now be regularly inspected and examinations made more often than was possible heretofore. In addition to the work of the branch laboratories there should be considered the 2,431 samples examined in the Washington Food Inspection Laboratory, of which 790 were check samples, 994 samples examined in the Washington Drug Inspection Laboratory, of which the greater part were original samples, and about 1,229 interstate samples in the other divisions handling extracts, waters, grains, and cattle foods, a total of approximately 4,654 interstate samples examined at Washington.

SPECIAL FOOD INVESTIGATIONS AND RESEARCHES.

From time to time conditions disclosed by inspection or questions raised in the administration of the law render it necessary to make special studies of certain classes of foods or drugs in order to determine the condition of the output as a whole, fix upon reasonable limits of composition and sanitation within which the products should fall, and if possible assist the producer by the scientific study of the problem under commercial conditions, in meeting the new requirements and improving the material in question. Investigations of this character have been conducted especially in regard to fruit products, dairy products, oysters, and fish. Other researches are of a purely scientific character looking to the development of new or improved processes as in some of the fruit work.

FRUIT AND FRUIT PRODUCTS.

WORMY AND UNSOUND FRUIT.—Many kinds of fruit when sold in bulk and in packages which are not hermetically sealed are subject to the attack of insects unless they are carefully stored, and become wormy and entirely unfit for food. Ripe olives, for example, in bulk, were often found to be of this character. Again, in some countries the practice has prevailed of drying fruits in such a manner that they are attacked by insects before or during the process of drying, so that by the time the product is placed upon the market it is sometimes badly infected by worms or the larvæ and excreta of certain insects. This problem has been carefully studied in various phases. Numerous seizures have been made of dried fruits which were held by the courts as unfit for food because of their wormy condition. A marked

improvement has already been made in the grade of figs offered for entry and doubtless it will be still further improved.

MAPLE PRODUCTS.—The prevalent sophistication of maple products has given rise to many cases under the food law, and from the necessity of judging of the purity of commercial samples made in different ways and with admixtures of various kinds has resulted a general study of authentic maple products gathered from all of the important centers of production in this country and in Canada. A study of methods of manufacture accompanied the analytical examination of the 481 samples obtained, thus furnishing reliable data for judging of the quality of this product whatever its source might be. Previous work on this subject has covered only limited areas or localities. The results indicate that methods of manufacture influence the variations in color and flavor of the finished product to a greater extent than does the environment.

VINEGAR.—The many cases arising in regard to sophisticated vinegars, especially those in which inferior products are labeled as cider vinegar, has led to a thorough investigation of this industry. Authentic samples were obtained for study at a number of factories throughout the Eastern and Central States, where every stage of the operations could be observed and data established in regard to the progressive composition of the product. In this way such sophistications as the use of vinegar made from apple wastes, dried skins, and cores, or the admixture of pomace and second-pressing vinegars with pure-cider vinegar, or their dilution with grain or white-cider vinegar or with boiled cider may be detected by comparison with the standard data. The results obtained have already been of great value and have made it possible to interpret more intelligently the analytical results obtained in the examination of unknown samples.

MISCELLANEOUS FRUIT PRODUCTS.—A large number of studies were made in cooperation between the Pomologist of the Bureau of Plant Industry and the Bureau of Chemistry looking to the development of new fruit products, the improvement of present processes, and the more profitable utilization of certain crops. Among these are investigations of the yields obtained by different methods of producing grape juice; the effect of storage at low temperatures on sweet ciders, showing that it may be held from six weeks to three months at 32° F. before fermentation begins, that it ferments very slowly and retains its flavor well if withdrawn and held at refrigerator temperature; a successful attempt to produce a marketable vinegar from peaches; the production of a very palatable product by drying and sugaring pineapples; a study of the practice of picking immature oranges and grape fruit and sweating them to produce quick ripening which showed that the product was very inferior and if followed might injure the industry; and a study of the production of citrus by-products in

California, together with the examination of authentic samples of Sicilian citrus oils.

Extensive enological investigations were conducted at Charlottesville, Va., with a temporary laboratory in the grape belt of northern Ohio, at Sandusky, where 1,077 samples of apples and grapes and their by-products have been examined during this year. Various methods of sophistication were applied and the chemical history of the product studied, as the data are used to assist in administering the food law. A parallel study is made of the composition of products of known history made in the laboratory which provides valuable data on the composition of 62 wines made under controlled conditions from nearly all of the important varieties of grapes used for this purpose in the eastern part of the country. This work is further elaborated by the systematic collection and examination of commercial samples, data on 316 such samples having been accumulated so far. Yeast cultures of different varieties found to have special value are still furnished as starters to laboratories and manufacturers with instruction as to their use, thus aiding in improving the technique of fermentation industries and the quality of the output.

DAIRY PRODUCTS AND POULTRY.

DETERIORATION OF POULTRY AND EGGS.—The study of the deterioration of poultry and eggs, which at first was concerned chiefly with changes occurring during storage, has broadened out so as include every step in the handling of these products. It was soon found that in no other way could the problems involved be attacked, inasmuch as the chemical and bacteriological data obtained could only be intelligently interpreted by a knowledge of the history of the product before entering storage, including methods of killing, dressing, shipping, and marketing. To this end the cooperation of associations of poultry dressers, merchants, railways, refrigeration transportation companies, and warehousemen has been obtained and the most interesting and instructive data have been assembled. The interrelations established explain many variations in data, and in turn the scientific observations set their stamp plainly upon the various methods as producing satisfactory or unsatisfactory products. Extensive shipping experiments were made from Chicago as a center. After visiting the large poultry packing houses throughout the Middle West, observing their methods, and making an accurate record of every detail of manipulation, shipments were sent to Chicago, the carload was met on its arrival, samples were taken for laboratory work, the condition of the car and its contents were examined, including the temperature records, and some of the packages were followed further through the warehouses and the market handling, including in several cases a second shipment by rail.

Specific practical points observed to have a direct bearing on the quality and keeping properties of the product have been studied in the field laboratories located at packing houses—for example, the best way of killing and bleeding fowls and the proper implement to use for the purpose, on which circulars have been issued. The variations in drawn and undrawn poultry were experimentally studied on a commercial scale, as were also the comparative merits of scalded and dry-picked fowls. In every case the chemical and bacteriological changes determined are correlated with the history of the shipment and of the conditions of the experiment, and in this way the many factors entering into the problem are controlled. Shipments were made in hot and cold weather and, as far as possible, all the variations occurring in actual practice were duplicated and their effect on the problem weighed. An investigation of the egg industry along exactly the same lines has been inaugurated, data having already been obtained on the changes taking place in eggs of known history and of low commercial grade, during varying periods of storage and at different temperatures, which will serve as the scientific basis for the study of commercial conditions.

Desiccated eggs.—Eggs put up in bulk, either frozen or dried, have disclosed in a number of instances the presence of decayed and filthy substance, showing plainly that either purposely or through carelessness spoiled eggs are broken into the cans. A number of notices of judgment have been issued in such cases, and it was deemed wise to make a thorough inspection of egg-packing establishments, observing the procedure from the candling of the eggs to the finishing of the product, and accompanying the inspection with the sampling of the output at various stages for the making of chemical and especially bacteriological examinations. It is obvious that the main consideration is the use of fresh material under sanitary conditions, but it was also developed that some of the details of handling in various packing houses result in lower bacterial counts and a better product than others, and suggestions will be made along these lines.

Condensed milks.—An extensive investigation of this product, so widely used and relied upon to furnish nutriment for the young, was ordered because of the fact that the manufacturers claimed that the present requirement of 28 per cent of total solids was unreasonable, it being impossible to produce a uniform product of this composition in different parts of the country and at different seasons of the year and have it meet the requirements in other respects. In order to insure justice to the consumer and producer alike establishments of this character have been visited throughout the country, and especially on the Pacific coast, to obtain data in regard to the character of the raw material and methods of manufacture which, together with the chemical examination of the finished products of known history,

will provide indisputable data for the settlement of this mooted question. The inspection has been completed and the results are in process of compilation.

Interstate shipments of milk.—From time to time the milk supply entering interstate commerce at various large cities is inspected with a view to determining its purity, not only by reason of such adulterations as watering, skimming, etc., but also bacteriological contamination resulting from improper treatment of the cattle, insanitary surroundings, etc.

FISH AND OYSTERS.

Codfish.—The causes and conditions incident to the spoilage of codfish and other salt fish, particularly during the summer months, were studied, the inspection being accompanied by the necessary microscopical and chemical examinations. It appears that the organisms causing the characteristic reddening of the infected fish occur normally in the localities where the fish are packed and are present in the salt used for curing, exhibiting an unusual toleration for this substance. While the specific organisms causing the spoilage have been determined and some of the conditions favorable to their development established, on which practical suggestions to the trade may be based, the problem must be further studied before the difficulty can be perfectly controlled. The use of pure water for washing the fish, of disinfectants in the packing houses and holds of vessels, and of improved sanitary methods of handling will go far to solve the problem.

Oysters.—The danger of contamination of the oyster and clam supply, especially from sewage, but also from conditions under which they are floated, handled, and shipped, was carefully studied. In the prosecution of this investigation many of the largest oyster beds were inspected, location of sewer pipes, etc., observed, methods of handling and shipping studied, and samples of water and oysters taken for bacteriological examination. In many cases conditions of grave danger were observed, which call for the most intelligent and painstaking care to prevent pollution of the supply—the floating of oysters in unclean water, etc. The data obtained have been collated and it is thought that the presentation of the facts, together with sustained inspection, will result in a decided improvement in conditions and point out to the industries concerned the necessity for watchfulness in these particulars.

FOOD CONTAINERS.

Marked progress has been made in the study of the relation of the character of the container to the tin content and keeping properties of canned goods in general. Recent developments in the manufac-

ture of tin plate have been largely in the direction of the preparation of a cheaper product, and one of the efforts of the manufacturers has been to give the plate as light a coat of tin as possible. Since it is manifestly impossible to apply to iron plate a thin coating of tin which is entirely impervious, it follows that in the thinner coats the imperfections in the coating are larger and more numerous. Again, the iron plates employed for coating with tin vary in weight according to the size and character of the package. Tin plate of good quality has been found to be suitable for the preservation of the majority of foods, but when the receptacles are made of inferior plate, not only is the tin dissolved in quite large quantities so as to impair the healthfulness of the product, but the coloring matter in many articles of food is unnecessarily destroyed. Some strongly acid foods attack even the better grades of tin, as, for instance, in the case of sardines in mustard, where practically all of the inner coating of the cans may be dissolved in a few weeks. It is highly desirable that a container be found which will be both economical and hygienic, and which will afford inexpensive packages of proper strength yielding no foreign constituents to their contents.

BLEACHED FLOUR.

The trial of two bleached-flour cases during the year was accompanied by the continuation of certain scientific inquiries furnishing data on the effects of bleaching. These have included studies made at the St. Paul and Chicago inspection laboratories with special reference to the grade or quality of flour bleached and the detection of lower grade flours bleached and labeled as Patent, and the comparative effects of bleaching and aging on the physical properties and chemical composition of the product, using patent and clear flours from 15 different localities. Pharmacological studies on the effect of nitrites on smaller animals were also made.

DRUG INSPECTION AND RELATED RESEARCHES.

IMPORTED DRUGS.

The quality of crude drugs, especially those received at the New York port, continues to improve. During the present fiscal year alone the character of certain drug importations has changed markedly for the better, as, for example, in the case of henbane, the importation of the spurious variety having been abandoned, and saffron, no longer containing excessive amounts of styles, or calendula florets colored with coal-tar dye, etc. The inferior materials now received are due principally to careless handling and curing rather than to gross adulteration. The medicinal preparations received, however, continue to be characterized in many cases by mislabeling as to the presence of alcohol, ether, opium, morphine, etc., or extravagant or

misleading claims as to their efficacy. An especially reprehensible practice is the importation of cough lozenges, tonic pills, etc., containing opium or morphine. Sometimes these are offered especially for the use of those addicted to the morphine habit, and again as a cure for consumption and other diseases. Goods of this nature, put up attractively as a confection and recommended for children's diseases, can be indiscriminately sold and be productive of great harm. Vigorous efforts are made to apprehend such products and prohibit their entry as dangerous to health.

DOMESTIC DRUGS.

The general character of adulteration is the same in the domestic as in the imported drug products. Especial attention has been given, both in connection with the operations of the Post-Office in obtaining fraud orders and by independent work under the food and drug law, to the proper control of the proprietary and patent medicines advertised as cancer, consumption, and epilepsy cures, and the proper labeling of headache remedies, cough sirups, etc., which contain habit-forming drugs and are indiscriminately taken by the general public without knowledge of their dangerous properties. Infant remedies containing morphine or codein are a peculiarly flagrant instance of this abuse, while in other cases the materials offered are harmless but ineffective and are sold for much more than their value, constituting merely a fraud. The work on medicated soft drinks has been continued and of the 15 new brands examined this year all were found to contain caffein and 6 showed small amounts of cocain. The indiscriminate use of the latter drug is one of the most insidious of the threatening evils in this line, its illicit sale even among children having been discovered in some localities.

The educational feature of the work pertaining to the use of remedies or beverages containing habit-forming drugs was felt to be so essential in safeguarding the public health that a popular bulletin was issued on the subject and given a wide distribution, awakening the keenest interest in the press and among physicians, as well as among the general public.

DRUG RESEARCHES.

Research work on the improvement of methods for the determination of synthetic products such as acetanilid, salicylic acid, antipyrin, codein, etc., constitutes an important part of the work, inasmuch as it is necessary to verify accurately the amounts declared on the labels of the many remedies in which they appear as the most important constituent. The origin and sophistication of essential oils, such as peppermint and wintergreen, are subjects of an extensive investigation to determine whether different varieties of plants grown under different conditions yield oils varying from the pharmacopœial

standards, and to establish methods for the satisfactory discrimination between the mixtures of substitutes and the genuine articles.

An extensive investigation of the character of the various glacial phosphoric acids on the market was made, the results showing plainly that this product consists of variable mixtures of meta-, pyro-, and ortho-phosphoric acids with varying amounts of sodium phosphate. It also appeared that the reversion of the glacial acid occurred not only in commercial brands but in pure meta-phosphoric acid made in the laboratory. Obviously an article of such variable composition should not be used in manufacturing medicines or compounding prescriptions.

MISCELLANEOUS INVESTIGATIONS.

INSECTICIDES AND FUNGICIDES.—The increase of the efficiency of insecticides and fungicides with the control or decrease of the injury done to the plant or tree by their application is constantly the subject of study by the Bureaus of Chemistry, Entomology, and Plant Industry working in cooperation. During the year eight studies of the kind were made, one of the most important being for the purpose of determining the efficiency of sodium cyanid as a substitute for potassium cyanid in fumigating operations, the best proportions to be employed in making the mixture, and the effect of the impurities present in the cyanid on the reaction. The results proved to be of considerable economic value. Lead arsenate has been exhaustively studied, including the examination of 50 commercial samples, directions for preparing this insecticide on the farm, the analyses of the materials entering into its preparation, and observations on the effect of lead arsenates and the impurities present on peach foliage. Orchard tests with numerous poisonous materials are in progress.

TRADE WASTES.—Chemical investigations of the nature and extent of injury to agricultural interests and forests resulting from the fumes, tailings, and other wastes from smelters have been made in cooperation with the Department of Justice, the principal scenes of the operations during the past year having been at Anaconda, Mont., and Ducktown, Tenn. At the latter place plants have recently been erected to condense the sulphur trioxid and dioxid fumes and manufacture sulphuric acid therefrom, thus converting an injurious waste into a profitable by-product. This process has been made the subject of special study. The effect of copper salts on certain grain crops was also investigated to determine the effect of tailings from smelters on farm crops irrigated with water contaminated by such wastes.

CHEMICAL WORK ON PLANT PHYSIOLOGY.—In the majority of studies on plant physiology the effects produced by varying conditions, the periodic changes in composition during the growth of the plant, and the quality of the products yielded by the experiments

must be tested by chemical determinations. In collaboration with the offices of the Bureau of Plant Industry, therefore, many such studies are prosecuted, among which the following are of special interest and utility: Acidity studies of peat to determine whether the samples are suitable for the growing of blueberries; determination of the nutritive constituents of cereals when grown under different conditions; the determination of changes in composition of a large number of varieties of barley when grown in the same locality for a number of years; the determination of the plant food absorbed by plants grown under different conditions, with a view especially to determining the influence of crop rotation; the composition of cereals, mainly barley and wheat, at different stages of growth, to determine when they can be most advantageously harvested; studies on barley with special reference to its malting qualities; changes in composition of cereals during storage, and the translocation of plant food and the elaboration of plant material during the early stages of the plant's life.

Turpentine and rosin investigations.—The waste in the production of turpentine and rosin is very large, both in the woods and at the still, and the various problems connected with their production, grading, and adulteration have been made the subject of extended inquiry. The errors in vogue in methods of grading rosin have occasioned great loss to the producer, owing to the fact that he can not know what grade of product he has obtained until the factor through whom it is sold reports the same. An accurate but simple and inexpensive method of grading the product at the still has been devised, and its use will, it is believed, enable the turpentine farmer to check the grading of his product and thus materially increase his income. The preparation of permanent rosin types, against which those actually used in grading may be checked from time to time, is being considered, as well as investigations looking to the improvement of the quality of the rosin itself.

The chemical control of contract supplies.—The efficacy of this control of the quality of materials purchased on contract is attested by the increasing demands made from the various Departments for such work, a total of 2,829 samples having been examined, exclusive of 3,600 pieces of apparatus tested for the Bureau of Chemistry. The preparation of specifications for miscellaneous supplies constitutes an important feature of the work, and renders examination of competitive samples in many cases unnecessary when the contracts are let on the bases thus established. The distribution of the work includes colors, paints, varnishes, oils, fats and waxes, soaps, and typewriter ribbons among the largest classes of materials examined.

BUREAU OF SOILS.

SOIL SURVEY.

The Bureau of Soils has vigorously prosecuted the study of the soil resources of the United States during the past year through both field service and laboratories.

Soil surveys were carried on in fifty-nine different areas in twenty-six different States, and as a result 22,762 square miles were covered in detailed work and 79,108 square miles of reconnoissance surveys, mainly in the Great Plains region. A total area of 359,564 square miles, or 230,120,960 acres, have been surveyed and mapped since active field work was begun in 1899. General interest in the soil survey work has rapidly increased. The interests served by and the agricultural development resulting from these surveys are very large, though not readily expressed in figures.

The Survey has cooperated during the year with state organizations in New York, Pennsylvania, New Jersey, West Virginia, North Carolina, Alabama, Mississippi, Missouri, Wisconsin, and Washington. State funds have been used to facilitate and expedite the soil survey work in localities of especial interest to the local state authorities.

With the final occupation of the arable lands of the country, which has been practically accomplished, and coincident with the rapidly increasing population, it is clear that the pioneer methods of agriculture are inadequate for the increasing needs of our people. The time has come when a more intensive and more stable system of agriculture must prevail. The basis for this change is the intelligent use and control of our soil resources.

In the Eastern States adjacent to the larger markets the situation is due to a too widespread adhesion to methods of the past. The soils of the Eastern States, however, are fundamentally sound and are as well suited now to intensive and intelligent culture as they were originally to pioneer and extensive use. There is abundant evidence that with a thorough knowledge of the soils and the intelligent application of modern intensive methods the yields per acre of our staple crops can be increased many times. The soil surveys in New York and the New England States, in Pennsylvania, Maryland, and Virginia, representing the longest occupied soils of the country, justify the confident assertion that these older soils await merely more intensive methods in order to respond more bountifully than ever before. The soil survey is the foundation for future work, outlining the different types of soils and describing their peculiarities and their requirements, while laboratory investigations are showing the many interdependent functions of soils and how they are susceptible of control by human agencies.

The soil surveys are showing the vast opportunities of specialization in the large number of soils of the Atlantic and Gulf Coastal

States. They are showing similar opportunities for specialization in truck, fruit, and general farm crops on the many types of soils in the Glacial Lake region of the North. They are showing the soil opportunities in our limestone valleys and the great Central West for the production of our great grain, forage, and fruit crops for the fall and winter markets. In the region of the Great Plains the different soils are being outlined which have a direct and dominant value in the distribution of crops under dry-land farming. In the western valleys and the reclamation projects the soils and alkali conditions are being mapped as a guide to the use and treatment of the soils under irrigation. On the Pacific coast the surveys are mapping the soils adapted to the important interests of that section, including the production of general farm crops and the highly specialized fruit and truck interests.

The Great Lakes region possesses some of the most valuable agricultural land in the United States, and upon the best of its soils the highest types of mixed dairy and general farming are developed. The northern part of the region, however, contains many thousand acres of light sandy soil which has heretofore yielded but little of either natural forest products or subsequent farm crops. Experiments of a practical nature and on a regular farm basis, both by scientific experiments and pioneer farmers, are, however, demonstrating the fact that even the loose, sandy jack-pine lands can be profitably cultivated when just the proper methods are employed. The proper crop adaptations of these glacial soils of widely different characteristics and capabilities are being studied by the Bureau. The information gained from both detailed and reconnoissance soil surveys aids greatly in the intelligent selection and uses of the soils in a sparsely settled region of cheap lands as well as in the more intensively cultivated areas where comfortable livings can be made from smaller farms of higher price and greater productive capacity.

The ravages of the cotton boll weevil in the Gulf States has created an intense interest in the diversification of crops on the one hand and the specialization of crops and agricultural interests on the other. Consequently that section of the country has been especially urgent for increased knowledge of its soils as a safe and fundamental guide in its development.

The reconnoissance survey of the Great Plains region, begun in 1908, was continued by the survey of three additional areas; one in the central Gulf coast of Texas, another in the panhandle of the same State, and the third included the entire western half of Kansas.

These reconnoissance surveys show the general character and distribution of the different kinds of soils in the area covered, their relative agricultural possibilities, and the crops which have been and will prove most successful. They furnish a large amount of valuable

and accurate information, not only to prospective settlers but also to those farmers who are already in the areas. The rapid development of these sections created an immense demand for these reports and some of those already published were exhausted within four months of their issue. This work will continue during the winter with the survey of another area in south Texas, to be followed next summer by one in western Nebraska.

The reconnoissance work on the soils of the Ozark region of Missouri and Arkansas, begun in 1909, was completed in 1910. The area covers a large part of the territory of both States lying between the Missouri and Arkansas rivers, amounting to about 58,000 square miles. The agriculture of the region is just now at a turning point in its development. The continued use of the soils, as though in the pioneer stage, is no longer possible on account of a number of changes, both natural and artificial. The farmers are seeking to adjust themselves to the new conditions, but with only moderate success in a few localities. The study of the soils of the region at this time is most urgently needed.

In cooperation with the Washington geological survey an extensive area of logged-off and burned-over lands in the vicinity of Puget Sound has been surveyed. The results will provide a basis for active state aid in clearing and developing these unproductive lands, including reforestation of such tracts as are unsuited to ordinary farm crops.

In cooperation with the Pennsylvania State College of Agriculture a reconnoissance survey has been made of the high plateau of the western half of the State. This great work will be completed in that State within a year or two and will be followed as rapidly as possible by detailed surveys of the more important centers of agricultural occupation.

SOIL-WATER INVESTIGATIONS.

Soil-water investigations naturally fall into two major lines—that of the surface waters which are likely to erode the soil and injure the field by rendering the surface rough and uncultivable and carry off the most productive portion, and that of the subsurface waters which move through the soil, resembling a great arterial flow in carrying material from place to place and performing an important function in maintaining stable conditions for crops and the permanency of the soil itself. Especial attention has been given to this latter line of work during the past year.

The soil-water investigations both on the Great Plains and in valleys among the mountains show the great extent and agricultural importance of the ground waters. In the Great Plains these waters, derived partly from local rainfall, but largely from the heavier precipitation in the mountains, permeate the formations and deposits, pass

through them at widely varying rates, and approach the surface under their particular hydrostatic head, often within reach of the ordinary capillary movements. When thus brought near the surface the waters improve the constitution and increase the productivity of the soil. Even at greater depths they are generally within reach of wells; and they supply the springs and seep-fed streams required for the use of stock. These waters, often neglected, materially increase the productivity and habitability of the Great Plains and of many valleys in the mountain region, and more especially where they are conserved for crop growth through dust mulching.

LABORATORY INVESTIGATIONS.

The progress of the laboratory investigations has emphasized that a soil has so many properties, physical, chemical, and biological, each of importance in the production of crops, that it is essentially an individual, and that no two soils are or can be made just exactly alike. Everything in a soil is involved in continual changes, and these changes are of as much importance to plant growth as are the things themselves. Cultural methods never affect one only, but always every factor involved in crop production. For instance, an addition to the store of plant food in the soil sometimes produces undesirable physical or biological conditions, with decrease in crop results. The interrelations between the soil factors influencing crop production and an intelligent control by cultural methods is perhaps the most important problem with which scientists are now engaged, and whose solution is a primary object of the Bureau's work. Among the results of the past year's work and of more general interest the following may be cited:

Relatively small quantities of mineral fertilizers produce profound physical changes in the soil water, affecting its movements. The addition of such substances to a soil affects in definite ways that content of water which is the optimum for plant growth, an important factor, since the soil solution and its accessibility to the growing plant are dominant factors in determining the kind and amount of plant growth. All the physical properties dependent upon the relation of the soil to its water content affect plant growth and are affected by any one of the general methods of soil control, namely, tillage, crop rotation, or fertilizers. The relation of physical properties to the moisture content of a soil is being studied vigorously.

Soils are far more heterogeneous than the rocks; in fact, all kinds of rock-forming minerals are found in nearly every soil and among the soil particles of all sizes. Certain characteristics of particular minerals show the nature of the geological processes involved in the formation of the soil which affect their adaptation to crops. All the mineral-forming elements may be expected in practically every soil;

this has been shown for barium, as well as the usual plant foods. Furthermore, even very old soils, long under cultivation, are essentially the same in mineral characteristics as new and virgin soils. Chinese soils, which are authoritatively reported to have been under clean cultivation for upward of three thousand years, contain all the common rock-forming minerals, and have an even higher content of the essential mineral plant nutrients than well-known and highly productive soils in the United States.

Important results have been obtained in certain lines of work pursued in connection with soil-fertility investigations. The new point of view which has been brought to bear on the problems connected with the fertility of soils has opened up avenues of profitable investigation and already forecasted results of great economic importance. Whatever adds to the biochemical knowledge of soils advances and broadens our understanding of the complex problems of soil fertility. Important facts have been ascertained in regard to the functional activities of soils, such as oxidation, reduction, etc., and their bearing upon soil fertility determined. The isolation in a pure condition of some of the organic constituents of soils has made possible the correct interpretation of soil changes and the discovery of compounds in the soil harmful to crops. This line of research has been especially profitable this year and has led to the separation of more than twenty definite compounds. Previous to this investigation not a single organic constituent of the soil was known, and the results thus far obtained are very gratifying. There has been studied the effect of these compounds, and of the soils containing them, on plant growth and the ameliorating effect of certain treatments of the soil and the addition of fertilizers. It has been found that fertilizers aid very materially in counteracting the effects of such soil constituents and that certain treatments destroy or remove them entirely.

THE USE OF SOILS.

In the twelve years which have elapsed since the initiation of the soil survey the Bureau has accumulated a vast amount of material concerning the soil resources of the United States. Much of this material is scattered through the annual volumes of the Field Operations, but much is in other publications and unpublished records.

It has been found during the past year that the time has come when it is possible to prepare a comprehensive statement of our soil resources, showing the origin, extent, distribution of, and the uses to which each individual soil type is being placed and can best be placed. A series of reports or monographs is under preparation upon the characteristic soils of each of the soil provinces into which the country is naturally divided. These monographs will constitute an inventory of all of the more important facts concerning the soils

of the entire country, the production that is now obtained from them, and the possibilities which they hold for the Nation's future. They will furnish a basis for the future development of the agriculture of the American people of a character and breadth of scope never before available to any Nation.

BUREAU OF ENTOMOLOGY.

The work of the Bureau of Entomology as a whole is divided into sections or main projects, which include work on the gipsy moth and the brown-tail moth, importations of useful insects, exportations of useful insects, investigations of insects damaging southern field crops, of insects damaging forests, of those injuring deciduous fruit trees, of those which prey upon cereal crops and forage plants, of those which injure vegetable crops, of those affecting citrus fruits, and of those which destroy stored foods, as well as investigations of insects in their direct relation to the health of man and domestic animals, and the study of bee culture in a broad way. Such inspection as can be done under existing laws comprises another aspect of the Bureau's efforts. Only a few of these projects will be touched upon here.

WORK ON THE GIPSY MOTH AND THE BROWN-TAIL MOTH.

The largest problem, from the point of view of financial expenditure, which comes under the work of this Bureau, is the effort to restrict the spread of these two insects, which have been doing an enormous amount of damage to the trees of certain New England States and which threaten to extend their range to other portions of the country. The States involved are Massachusetts, New Hampshire, Maine, Rhode Island, and Connecticut. Realizing from the start the practical impossibility of establishing a quarantine line around the limits of distribution and working back toward a common center, it was decided that, since the gipsy moth spreads principally in the caterpillar stage (the female moth being unable to fly), and largely by dropping from roadside trees upon passing individuals and vehicles, the best results could be accomplished in an effort to prevent this sort of spread by cleaning up the roadsides in the most thickly infested and most traveled sections. It was decided that the brown-tail moth, having extended powers of flight, could not be controlled by any such method, but that, owing to the prevailing direction of the winds at the season of flight, its spread to the west and south would always be comparatively slow. Therefore the efforts with this species have been to urge upon the States concerned the enforcement of state laws already in existence and to take part in the general campaign of the education of people in regard to the habits of the insect, and to encourage in every way the destruction of the winter nests, since, during the season when the leaves are off the trees, these nests are readily observable and can be picked off and destroyed.

As the result of the work carried on down to the present time, the living conditions in the infested area have been vastly improved and the spread of the gipsy moth has been greatly retarded. Street and roadside trees have, as a rule, retained their full foliage, and no great loss of verdure is now noticeable except in forested areas. This is in vivid contrast to the conditions which existed at the beginning of the work. Even in forested areas there has been no extensive death of trees owing to complete defoliation. The reason for this is that the destruction of the leaves of a given area for two consecutive years seldom or never happens. When a woodland colony of the gipsy moth increases to such a size as to bring about the complete defoliation of an area, the numbers of the caterpillars are so great as to cause their death by millions from overcrowding, disease, starvation, and the attacks of natural enemies. It results that practically only those individuals on the border of the area survive and propagate, so that the following season not the old area but a contiguous area receives the attention of their offspring.

Aside from the clearing up of roadsides, extensive search during the winter season is carried on all around the borders of the area known to be infested, in order to discover at the earliest possible date either new colonies or those which have existed for some years but which have not before been found. Egg masses, where found, are destroyed. In the early summer, after eggs have hatched, extensive spraying operations with arsenical mixtures are carried on. Many trees are banded with a sticky mixture to prevent the ascent of caterpillars. By arrangements with the railroad companies, all shipments of lumber and all articles likely to carry the eggs of the gipsy moth from within the infested territory to other parts of the country are inspected before shipment, in order to make it certain that the insect will not be spread by this mode of distribution.

In all of the States mentioned the Department works in hearty cooperation with the state authorities. Each of the States is assisting—Massachusetts, Maine, Connecticut, and Rhode Island effectively; New Hampshire not so effectively.

During the past fiscal year it has transpired that the infested area is somewhat larger, but the rate of increase has been shown to be proportionately less than it has been any year since the beginning of the work. The infested area in New England is now a little more than 10,500 square miles. The work in Massachusetts is carried on along the old lines. In New Hampshire about 100 men were kept in the State during the winter carrying on scouting operations and applying creosote to the egg clusters along the roadsides. This scouting indicated the presence of the gipsy moth in twenty-one towns where it had not theretofore been suspected. There were no large colonies, and in some of the towns only single egg clusters were

found. There seems to be little hope of controlling the gipsy moth in New Hampshire until the authorities appreciate more fully the serious character of the threatened damage. A local organization should be brought about in each city and town, under state supervision, and a constant concerted effort should be begun. There is the same necessity for concerted work in this State against the brown-tail moth. Conditions in Maine as compared with New Hampshire are much better. Some large new colonies were located by scouting, but some of the older ones seem to have been extirpated. The brown-tail moth seems possibly to have reached the northern limit at which it can thrive in Maine. The condition in Rhode Island is very favorable, and the gipsy moth is less abundant in that State than at any time since its control was undertaken. In Connecticut the colony near Stonington is nearly exterminated; less than 100 caterpillars were found there during the summer of 1909, while in the following winter but a single egg cluster could be found by the combined efforts of the state people and the Government people. This very promising condition at Stonington, which heretofore has been the only infested town in the State, was offset by the discovery in December, 1909, of a bad colony in the town of Wallingford, near New Haven, which has probably existed there for three or four years undiscovered. The colony, however, seems to be definitely limited, and strong efforts are being made to exterminate it.

Slow but steady improvements in methods have been made and practical new points in the economy of the gipsy moth have been discovered. The hitherto only known method of spread has not explained perfectly the presence of this insect in entirely isolated woodland colonies, and this year a careful series of experiments has shown that the newly hatched caterpillars may be distributed by the wind—in fact, it has been definitely proved that they have been carried in this way for more than 1,800 feet. This discovery will probably necessitate some modification in methods.

All of this work has necessarily been on a large scale, and the Department is experiencing considerable difficulty in securing first-class men. At times 500 men have been employed. Forty tons of arsenate of lead were used during the spraying season, and 20 tons of the sticky substance used for tree banding. The outlook, on the whole, is far from unfavorable, and surely the work carried on by the Bureau has been done in the most intelligent and efficient way.

THE IMPORTED PARASITES OF THE GIPSY MOTH AND THE BROWN-TAIL MOTH.

The work mentioned in the preceding paragraphs can not be expected to bring about the extermination of the two tree pests. This is made plain even in the wording of the appropriation act, by which Congress instructs that the money is to be spent in an effort

to prevent the spread of the gipsy and brown-tail moths. It is hoped, however, that it will minimize the damage and prevent undue spread until such a time as the parasites which have been and are being introduced from abroad shall have reduced the dangerous insects to a condition of comparative harmlessness. These efforts to introduce and acclimatize parasites which attack the injurious moths in their native homes have been carried on now for rather more than five years. The work has been novel in its character and entirely unprecedented in its scale, but it was initiated under more favorable conditions than could have occurred elsewhere in the world, on account of the intimate acquaintance possessed by members of the Bureau force with parasitic insects and their habits.

The progress made from year to year has been shown in my annual reports. It was at first hoped and even expected that appreciable results in the obvious lessening of the damage done would be perceived in a very few years—say three or more—but with a better understanding of European and Japanese conditions and with a closer knowledge of the biology and interrelations of these very minute creatures, complications have arisen which, while affording new and important light, have lengthened the estimate of the Bureau of the time needed to get the best results.

During the past fiscal year a larger amount of parasitized material was imported than ever before, and the thanks of the Department are due to officials in Italy, France, Spain, Portugal, Russia, and Japan for assistance in this work. Some very notable examples of progress have been observed. The European predatory beetle known as *Calosoma sycophanta* now exists in great numbers over a large area. It was so abundant in some localities the past year as to affect the gipsy moth materially. A parasitic fly of the genus Compsilura, first liberated in 1906, during the present season has been shown to have increased fiftyfold annually and to have spread 10 or 12 miles in every direction each year. It has destroyed large numbers of gipsy moths and an appreciable percentage of the brown-tail caterpillars, and is now turning its attention to certain native species, such as the fall webworm and the tussock moth, which, through their autumn feeding, afford food for a generation of the parasites at a time when the gipsy moth and the brown-tail moth are not available. Still another species has been found to attack the caterpillars of the cabbage butterfly as well as the two species for which it was imported. The European Monodontomerus, which was found last year to have spread over an area of approximately 500 square miles, has continued to increase and to disperse rapidly. It has crossed into New Hampshire, extending its range 10 miles in every direction, and must be at least twenty-five times as numerous this year as last. A parasite of the eggs of the gipsy moth (Anastatus) survived the winter of 1909-10 and appears to be strongly established. This para-

site will be of very considerable assistance, although alone it could not be a very serious check to the gipsy moth, since its larvæ destroy only the topmost eggs in a gipsy-moth egg mass and since it wastes many of its eggs. The condition of the parasite work, on the whole, is distinctly more encouraging than it has hitherto appeared to be.

WORK IN THE ORANGE AND LEMON GROVES OF CALIFORNIA AND FLORIDA.

One important investigation of the Bureau was completed with the close of the last fiscal year, namely, the study of the problem of hydrocyanic-acid gas fumigation in California directed against certain scale insects on citrus trees. The problem was attacked from all points of view, with the prime idea of increasing the efficiency of the process, which had previously been carried on in a wasteful and unscientific way, and of reducing its cost. It has been shown as a result that the extremely satisfactory increase in the efficiency of the process, brought about by the careful experimental work carried on, has in itself greatly reduced the cost, since one treatment under present methods is as lasting in its effects as three or four distinct treatments under old methods. A practical man in southern California, himself a large gainer through the results of this investigation, and who closely watched the Bureau's experts at their work, informs the Department that at least $250,000 has been saved to his region.

The work on the white fly in Florida has been carried on, and the principal efforts of the year have been with insecticides and spraying methods as adapted to Florida conditions. It has been found that by careful application of knowledge gained by studies of the life history of the white fly the cost can be reduced to two-thirds during late spring, while other experiments have shown that the cost can safely be reduced about one-half during the summer months on account of the greater susceptibility of the insect in the conditions in which it is to be found at that season. All efforts to adapt native parasites of allied insects to the citrus white fly having failed, and Congress having authorized a search for the foreign parasites of this destructive species, an expert agent has been sent abroad upon this important search and at latest advices was in India, which has been supposed by naturalists to be the original home of the white fly.

In my last annual report I called attention to a new insect enemy of the orange, in the shape of a thrips, which punctures the rind of the fruit, making it scabby and reducing its value. The same insect also injures the young leaves. An investigation of this insect has been carried out through the year, and large-scale experiments have been made with various sprays, some of which have been found to be successful. Unfortunately there is a series of generations of the

insect throughout the year, which renders two or three spray applications necessary. The Bureau has especially introduced spraying methods, and a large number of power sprayers have been purchased and extensive operations begun under the advice and immediate supervision of the agents of the Bureau. In less than a year the problem was practically solved and the means of protecting the crop was demonstrated.

WORK AGAINST FOREST INSECTS.

Previous investigations in work against forest insects have resulted in a thorough knowledge of the life histories and methods of work of the principal forest insects, and have indicated not only that the forest-insect problem is to be classed among the more important problems in connection with the waste of forest resources, but also that this waste can be controlled with economy and success. The Bureau, after obtaining the necessary preliminary results, is now in position to demonstrate upon as large a scale as this can be brought about the efficacy of the measures decided upon. It has been shown that the methods recommended may be easily understood and properly applied by owners of timber, by Government forest officials, and by managers of manufacturing enterprises through the proper expenditure of a comparatively small amount of money and energy. This has been shown in the areas in Colorado in the vicinity of Colorado Springs, Palmer Lake, and Idaho Springs, on the Trinchera estate, in the Las Animas National Forest, in the Wet Mountains section of the San Isabel National Forest, Colorado, and in the Jefferson National Forest, Montana. The evidence gathered from the results of the investigations and control work relating to these seven cases indicates that the proper disposal of a total of some 14,000 trees during a period of four years at a first cost of about $2,000 (an average of 50 cents per tree) has ended depredations which during a preceding period of ten years have caused an average annual death rate of more than 7,000 trees, or a total of 7,000,000 feet board measure, having a stumpage value of $14,000.

The work carried on in cooperation with private timber owners and forest officials in northwestern Montana, inaugurated last autumn, has yielded most satisfactory results, especially in the fact that the private owners have been made to realize the importance of prompt action to prevent the total destruction of the remaining merchantable timber. This has led to the proper treatment, by cutting and barking or otherwise disposing of between 9,000 and 10,000 beetle-infested trees, by ten or more of the owners. This, it is believed, will be sufficient to control the depredations over an area of more than a hundred square miles in which the timber has been dying at an alarming rate during the past ten or fifteen years. It will also have a marked effect

toward protecting the timber of the adjacent areas of the National Forests, in which similar destruction has been going on. The Department of the Interior has allotted sufficient funds to take immediate action in the southern section of the new Glacier National Park, and the Forest Service will take up the work within the Flathead and Blackfeet National Forests during the coming year. This work, in addition to the work of private owners, should effectually check the insects throughout the whole area, and thus end the losses of timber which have been progressing in this general region during the past ten years at a death rate of at least 200,000 trees annually.

During the close of the year there has been organized the most extensive cooperative project for the control of bark-beetle injury that has ever been undertaken in this country. This is in northeastern Oregon and western Idaho, and involves an area of over 13,000 square miles. It is undertaken through cooperation between the Bureau of Entomology, the Forest Service, and private owners, and provides that the experts of the Bureau of Entomology shall make investigations of the insects, recommend methods of procedure, and give special instructions and advice and essential details, while the Forest Service and the timber owners provide the funds necessary for actual control operations. It is expected that this work will prevent the further loss of timber which has been going on during the past five or six years at an estimated value of nearly a million trees per year.

INSPECTION WORK.

In my last report attention was called to the widespread introduction of the winter nests of the brown-tail moth upon apple and pear seedlings coming to the United States from portions of France, and an account was given of the methods adopted to secure the inspection of all imported material of this class at the point of ultimate destination. During the autumn and winter of 1909 similar injurious introductions constantly occurred. Very many nests of the brown-tail moth were brought in in this way, and an egg cluster of the gipsy moth was found upon stock sent from Belgium to Louisiana. By an especial arrangement with the Secretary of the Treasury, with the custom-houses, and with the railroads, the Bureau of Entomology was notified of all cases of plants received, and, as in the previous autumn and winter, the inspection of probably every shipment was secured at the point of ultimate destination. Shipments of nursery stock to the number of 291 were found infested with nests of the brown-tail moth, and these went to Colorado, Connecticut, Georgia, Illinois, Indiana, Kansas, Louisiana, Michigan, Montana, New Jersey, New York, Ohio, and Virginia. In most of these States inspection was rendered simple by the fact that there were efficient state inspection laws and efficient inspectors. Notification in such cases from

the Bureau was all that was necessary. In other cases, where there was no such state service, the inspection was carried on either by employees of the Bureau or by expert collaborators appointed for the purpose.

In addition all seeds and plants introduced and distributed by the Division of Foreign Seed and Plant Introduction of the Bureau of Plant Industry, as well as all ornamental plants imported by florists in the District of Columbia, have been thoroughly examined. Moreover, about 2,000 cherry trees, a gift from the city of Tokyo to the Government of the United States, were examined and found to be infested with a number of injurious insects, necessitating, most unfortunately, the destruction of all these plants.

The United States is practically the only one of the great nations of the world which is not protected by law from such accidentally caused importations of pests of this character. During the last session of Congress an inspection law, based upon the permit system, was drafted and submitted to Congress after consultation with the legislative committee of the National Nurserymen's Association. Thorough hearings on the bill were held before the Committee on Agriculture of the House, but, owing to pressure of other matters which seemed of more immediate weight during the closing portion of the session, the act was not placed on the calendar. The need, however, of a national quarantine and inspection law of this general form is a crying one, and the country is in constant danger of the importation and establishment of new pests of a serious character just as long as it does not protect itself in this way.

The extensive accidental importations of the brown-tail moth during the past two years have been due to somewhat unusual conditions in the nursery-growing regions in France, which have bettered much during the past season. During the growing season of 1910 in the nursery regions of France both the gipsy moth and the brown-tail moth were almost entirely absent, so that the danger of importation during the coming autumn and winter is undoubtedly less than during the two previous seasons. Both the Belgian and French Governments, largely owing to representations from this Department, have adopted regulations providing for the inspection of nursery stock exported to this country, and such action is expected on the part of England, Holland already having a competent service. These actions on the part of these Governments will alleviate conditions, but will by no means remove the necessity for a protective law in the United States.

OTHER WORK.

Among the other important affairs of the Bureau during the past fiscal year the following should be mentioned:

The continued work on the cotton boll weevil and other cotton insects in the South has shown good results in the utilization of native

parasites and in the study of the adaptation of the insects to the new conditions met with in its continued spread to the north and to the east. The work upon tobacco insects has progressed, and that upon sugar cane and rice insects has made a good start. The work upon the pear thrips in California, practically completed from the investigational side during the previous fiscal year, has been carried on by the conduct of large demonstrations which have indicated in a very perfect way the practical value of the conclusions previously reached. Studies and demonstrations with the codling moth have been continued. The work upon the grape root-worm has been completed, and an interesting investigation has been followed in the study of arsenic accumulations in the soils in sprayed woodlands, orchards, and vineyards. Demonstration spraying has been carried on against the plum curculio, and the investigation of cranberry insects is nearly completed. Further studies on the green bug, the joint-worms, and the Hessian fly have been carried on, and studies of two new pests, namely, the New Mexico range caterpillar and the alfalfa weevil in the West, have been begun. The work against truck-crop insects in Tidewater Virginia, in North Carolina, Colorado, Mississippi, California, and southern Texas have resulted in results of value to the growers of those regions. Studies of the house fly have been continued. The work on the Texas cattle tick has been forwarded, and a thorough investigation of the tick which carries the spotted fever of human beings in the Rocky Mountain regions has been begun. The investigations of stored-product insects have comprised a careful consideration of the point of infestation of export flour and experimental work in rice mills of the South. The work in bee culture has been devoted largely to the study of bee diseases, but other investigations in this direction are under way.

BUREAU OF BIOLOGICAL SURVEY.

The Bureau of Biological Survey has continued its investigations of the economic relations of our wild birds and mammals with special effort to render its work of practical importance to the farmer and stock grower. It is gratifying to note that as the work of the Bureau becomes more widely known it meets with increasing approval and support from those it is intended to benefit. A remarkable and, until recently, quite unexpected broadening of the work of the Survey into the field of the preservation of the public health has resulted through the fact that some of our native wild mammals have been proved to be disseminators of such fatal diseases as the bubonic plague and the spotted fever.

RATS AND THE BUBONIC PLAGUE.

So important is the rat in its relation to the public health that its extermination has become one of the serious problems of modern

times, both in the United States and in foreign countries. Since it has been established that plague is primarily a rat disease and that it is transmitted to human beings chiefly by the agency of the fleas which infest rats, this aspect of the problem has quite overshadowed the purely economic side of the matter, important as that is. During the year experiments with traps and poisons were conducted, these being the chief present available means for reducing the number of noxious rodents. So great are the rat's productive powers, however, that unless these measures are persistently and energetically pushed the relief obtained is only temporary. It can not be too strongly emphasized, therefore, that permanent freedom from the pest can be secured only by preventive measures. When a building is infested by rats, it can be freed from the vermin by stopping means of ingress, usually not difficult nor expensive, and then depriving the animals of food, when they can be easily trapped. What is true of single buildings is true of cities and communities. When the public is educated to the importance of withholding all food supplies from rats, and when buildings are made practically rat proof, a very long step will have been taken toward the solution of the rat problem.

Inasmuch as requests from various parts of the country as to the effectiveness of bacterial preparations for destroying rats continue to be received, the results of experiments of the Survey with several such preparations now on the market may be repeated. When fresh and virulent, the preparations can usually be depended on to kill the individual rats eating the prepared baits, but they do not set up, as has often been claimed, an epidemic among the rodents. They are hence regarded as inferior to poisons because of their uncertainty of action, ineffectiveness, and cost. The cost indeed is practically prohibitive when the preparations are required to be used on a large scale.

CALIFORNIA GROUND SQUIRREL.

The California ground squirrel continues to be the subject of important field investigations because it annually destroys millions of dollars worth of grain, fruit, and nuts, and because it tunnels in irrigation embankments. Thus in May, 1910, ground squirrels caused such a serious break in the Turlock Canal in Stanislaus County that the cost of the necessary repairs amounted to $25,000. As the repair work occupied some three months, the ranchers were deprived of water at the very season when most needed, the resulting loss of crops being estimated at upward of a half million dollars. Still more important is the fact that this squirrel has become plague-stricken. Already three or four persons are known to have been infected with plague from squirrels. The real significance of the spread of plague, however, to this wild mammal is not so much the present danger of infection of a greater or less number of persons, but the fact that

unless vigorous steps are taken the disease is likely to become permanently endemic in California, as it is in India among certain of the native rodents. Should plague become firmly established among ground squirrels or other of our rodents, there is danger that the disease in a virulent form may be communicated from them to human beings at any time; there is the added danger that as the distribution of squirrels over a large part of California and other Western States is practically continuous, the disease is likely to spread from colony to colony, to other parts of the State, and even to other States. Thus the plague epidemic in California, which at first sight might appear to be of purely local concern, assumes national importance and the destruction of ground squirrels becomes imperative. It is hence very important to exterminate the animals in the sections immediately contiguous to San Francisco, and by due care and vigilance to prevent their reentry into the freed territory. A neutral belt thus being established around San Francisco, and if necessary other seaports, and the agency of ground squirrels in the spread of plague being eliminated, should the disease at any future time enter San Francisco or any other of our west coast ports it can be restricted to very narrow limits, when its eradication will be comparatively easy.

With a view to a war against ground squirrels, investigations have been made during the year for the purpose of ascertaining the cheapest and most effective methods of killing them. Numerous experiments have been made with poisons and with baits for use in different localities and at different times of the year, and excellent results have been obtained.

After many experiments covering the dry season, whole barley has been found to be the best vehicle for carrying the strychnine, which, all things considered, has proved to be the most effective poison. The barley is coated with a starch solution holding strychnine in suspension. It has been demonstrated that by a single treatment the ground squirrels have been practically exterminated over large areas of wheat land at a cost less than one-half that of the methods that have hitherto been employed. Thus, during the past season careful tests of the starch-barley preparation over 50,000 acres in several localities in the State proved that ground squirrels can be practically exterminated over large areas at a cost of from 2½ to 6 cents per acre, depending on the abundance of the squirrels and other local conditions. The method has been tested widely enough to prove that during the dry season, from April till October 15, it can be successfully used in all parts of the State, and it works equally well on the three species of ground squirrels found there. The starch-barley preparation has the added advantage that it destroys practically no wild birds and may be safely employed in pastures, on sheep ranges, and along public highways.

Attention has been given also to the habits of the California ground squirrels, especially during the breeding season, since it is evident that the most effective way of reducing their numbers is to kill them prior to the time they have young, especially as they are very prolific and have from four to eleven at a birth.

RODENTS IN RELATION TO REFORESTATION.

One of the most important of modern forestry problems is the economical reforestation of treeless areas within our National Forests. When attempts at reforestation were made on a large scale by the Forest Service, it was found that, after seeding, on an average about half the seed planted was dug up and eaten or carried away by mice and chipmunks, thus adding largely to the cost of the undertaking. In some localities as high as 70 per cent of the seed has thus been lost, which loss is prohibitive of the work. As these rodents are exceedingly numerous within all forest areas and clearings, attempts at seeding without protecting the seed in some way or largely reducing the number of rodents proved practically hopeless. Accordingly, at the request of the Forest Service, experiments were begun by the Biological Survey for the purpose of finding a remedy. Many experiments were made to protect the seed with a coating of such substances as red lead, copper sulphate, and coal tar, but they failed. Attempts to poison the animals, however, have proved very successful. Oatmeal mixed with strychnine and water, or wheat coated with hot tallow mixed with strychnine as a protection against rain or moisture, proved very effective. The poison is distributed over the tract to be planted several days in advance of seeding operations, when the subsequent loss by rodents is inconsiderable. It is believed that the adoption of this plan will solve one of the chief difficulties connected with reforestation.

RODENTS AND SPOTTED FEVER.

It is believed that the dreaded spotted fever, which prevails in certain sections of the Rocky Mountain region, is transmitted to human beings by ticks which harbor on certain of our native mammals. As having an important bearing on the attempts to eradicate the disease, it is extremely important to ascertain the species of mammals concerned in its transmission. Hence the Survey was asked to cooperate with the Bureau of Entomology and the officials of the State of Montana in an investigation. Accordingly, two assistants of the Survey spent several months in Bitterroot Valley, Montana, trapping mammals, especially the smaller rodents, and studying their habits with a view to the discovery of the species that harbors ticks. So far fever ticks have been found on twelve species of wild mammals in and near the valley. It does not follow, however, that all ticks found on mammals are capable of transmitting the fever.

The ticks discovered and all mammals showing symptoms of disease were given to experts for examination. The results of the work of the past season should go far to aid in a solution of this important problem. Should it prove, as seems probable, that the Columbia ground squirrel or some other rodent is responsible for the spread of the disease through the agency of ticks, it is believed that a practicable plan can be devised for reducing the numbers of the animals within the confines of Bitterroot Valley and other inhabited localities in the Rocky Mountain region where the fever is prevalent, so that in future it need be little feared.

PRAIRIE DOGS.

In certain regions of the Middle West prairie dogs exist in great numbers, and so numerous are their colonies in certain places that they seem to form one continuous settlement. In such areas, where the little rodents number many thousands, the damage they do to forage grasses and other vegetation is very great. The extent of this damage can be realized when it is known that 35 prairie dogs during their season of activity eat as much grass as one sheep and 210 eat as much as a range steer. In the days of unlimited public pasturage such losses passed almost unnoticed, but the increasing value of grass lands for stock ranges makes it impossible to ignore them longer. In thickly settled farming communities the extermination of prairie dogs is comparatively easy, since it is possible to secure the necessary cooperation between landowners; but in sparsely settled areas and on large stock ranges cooperation is difficult or impossible to obtain, and the cost of extermination bears heavily on individual owners. To discover methods of destruction of the utmost efficiency and at a minimum of cost has been the endeavor of the Survey, and investigations to this end have been made during the past year in New Mexico, Colorado, Wyoming, and Montana, and are still in progress. Oats poisoned with strychnine have proved to be the most attractive bait so far experimented with, but as the use of this grain endangers the lives of valuable birds like shore larks and longspurs, further experiments will be made with a view to obviating this disadvantage.

BIRDS IN RELATION TO THE CODLING MOTH.

The codling moth occurs in every apple-growing region of the United States, and where no effort is made to check its ravages it destroys from a fourth to three-fourths of the crop. It has been estimated by assistants of the Bureau of Entomology that the annual loss in the United States due to the codling moth, including the cost of efforts to control its ravages, is 15 million dollars. In connection with an investigation of the bird enemies of this pest, preliminary work was done by an assistant of the Survey in the Blue

Ridge apple region of Virginia. Twenty-five species of native birds are known to prey upon this exceedingly destructive insect, and it is believed that birds destroy from 50 to 85 per cent of the hibernating pupæ. Thus they probably do more to check the increase of the codling moth than all other natural enemies combined.

MEANS OF ATTRACTING BIRDS TO ORCHARDS AND FARMS.

The destruction by birds of the codling moth, the boll weevil, and many other insect pests shows clearly not only that birds should be protected, but that efforts should be made to increase their numbers and so add to their effectiveness as auxiliaries of the farmer. During the year experiments have been initiated at the instance of the Survey, with a view to testing artificial nesting sites for this purpose. In Europe the use of artificial nests about houses and in orchards and groves has proved a great success. They not only attract numbers of birds like woodpeckers to a particular locality, where their services in destroying insects are much needed, but they actually increase the total number. Some such method as this is necessary in this country, where farmers and orchardists so generally plug up cavities in trees and trim off dead limbs, thus restricting the supply of nesting sites. This practice is actually diminishing the number of birds, like woodpeckers, bluebirds, and chickadees, that nest in cavities. The expenditure by the orchardist or the farmer of the small sums necessary to supply artificial bird boxes, whether purchased or homemade, will prove an exceedingly profitable investment, since it will increase the total number of birds and will attract to the places where they are most needed some of our most interesting and valuable species, whose destruction of insect pests will repay many times the small outlay made in their behalf.

BIOLOGICAL INVESTIGATIONS.

During the year, as usual, biological investigations covered a wide field and included several States. Field work was carried on in parts of Arizona, Arkansas, California, Illinois, Kentucky, Missouri, Montana, New Mexico, North Dakota, Oregon, Utah, and Wyoming. The data gathered enabled important corrections to be made in the zone map of the United States, a revised edition of which is now in press.

A report on the biological survey of Colorado is practically completed and will be published during the coming year. This includes a map of the State showing life and crop zones, with a general discussion of their relations, the adaptations to different crops of the several areas, and the species of plants and animals characterizing them. A full list of mammals of the State, with copious notes on habits, distribution, and economic relations, forms a part of the report.

A monograph of the wood rats of the genus *Neotoma* has been recently published as No. 31 of North American Fauna. Locally these animals do considerable damage, and a single individual in Alameda County, Cal., has been found by the Public Health and Marine-Hospital Service to be infected with plague, so that a knowledge of the distribution and habits of these mammals becomes doubly important.

A detailed survey of Wyoming, with special relation to its native mammals, birds, and distribution areas, is now being carried on as rapidly as possible, beginning with the sections in the Wind River and Bighorn valleys which are covered by the reclamation projects. The extent of the Upper Sonoran zone in these valleys, or the zone of corn and apples, and the crops best adapted to it, have been subjects of inquiry on the part of the Reclamation Service and of prospective settlers. At the request of the Director of the Reclamation Service a provisional report has been furnished on the life zones and crop adaptations in the Shoshone Project area, but more definite information is desired, and field work has been undertaken in order to define accurately the zone boundaries.

A few months of field work in New Mexico practically finished the survey of that territory, and a report on its life zones, mammals, and birds is now being prepared.

Work was continued in northern Arizona and southwestern Utah, but considerable field work is still necessary before the survey of these States can be completed.

The office work of mapping ranges of species of birds and mammals has been pushed vigorously, and the distribution of a large percentage of the mammals and birds of the United States has been mapped. These maps are constantly in use in planning field work, in investigations of beneficial or injurious species, and in other lines of work.

A large amount of information on the migration and distribution of North American birds has been gathered and tabulated for future reference. This information is in constant use in various reports and as a guide in formulating protective regulations for game and other useful birds and mammals.

Considerable field work has been done in the lower Mississippi Valley States, and a report on their faunal areas, birds, and mammals will be published as soon as possible after completion of the field work.

Only a limited amount of work was done in California during the year, but important facts on distribution were ascertained, which enabled many corrections to be made in the zone map of the State.

GAME PRESERVATION AND INTRODUCTION.

With the increasing settlement of the country and its growing population, our big game animals constantly diminish in number,

and unless suitable protection is given them the time is not far off when big game, except in game preserves, will be practically extinct. The chief function of the Federal Government in this connection is to stimulate and coordinate the action of the several States and to aid in solving the various protection problems as they arise. The same duties and similar problems are present in connection with the preservation of the birds of the country, both game and nongame. The danger of practical extermination is, however, more remote, especially in the case of nongame birds. To the Department, also, has been assigned the duty of preventing entry into the country of injurious birds and mammals. The danger that species will be imported that may, like the English sparrow, prove to be serious pests, is averted only by the system of inspection maintained at the principal ports of entry.

IMPORTATION OF BIRDS AND MAMMALS.

No serious attempt was made this year to introduce prohibited species. A mongoose surreptitiously entered at Everett, Wash., was discovered and killed a few weeks later, and two mongooses which it was sought to import from Habana were denied entry.

An incidental result of the establishment of a check on importations of eggs of game birds was the disclosure of the importation of terns' eggs from Jamaica for sale in the New York markets in a half-decomposed state as the eggs of Australian boobies. The Department united with the Treasury Department in suppressing this fraudulent traffic.

STARLING INVESTIGATION.

Reports have been received from time to time of the establishment and spread of the starlings that were liberated in Central Park, New York, twenty years ago. The latest observations show that these birds now range north to Springfield, Mass., and south to central New Jersey. As this bird has proved so great a pest in other countries that its further importation into the United States is specifically prohibited, an agent of the Department was directed to make a thorough investigation of its spread and the economic effect thereof. The results of this investigation will be given in my next report.

GAME PROTECTION IN ALASKA.

Under the new Alaska game law 11 wardens have been appointed by the governor and 21 guides have been registered. Several hunting and shipping licenses were issued by the governor, the proceeds of which are paid directly into the United States Treasury. Twenty-four permits were issued by this Department for collection and export of scientific specimens, and 13 specimens and 8 packages of specimens were entered at Seattle, Wash., during the year.

An application for permission to purchase deerskins for the manufacture of gloves and novelties for export from the Territory was referred to the Attorney-General, who rendered an opinion that this Department has no authority to grant such permission.

INFORMATION CONCERNING GAME.

As last year, statistics were gathered of the deer killed east of the Mississippi. The number was found to be 57,500, substantially the same as in 1908-9. Through the cooperation of the Forest Service much information was acquired of the location of deer, antelope, mountain sheep, and other species of big game on National Forests. This work will be continued and the results will be reported at a future date.

The extent of the destruction of deer by wolves in Michigan, Wisconsin, and Minnesota was personally investigated by a member of the Biological Survey, and sufficient evidence was gathered to show that this problem demands serious attention. Its consideration will be continued, and the results will be reported during the coming year.

The information secured last year on pheasant propagation was published as a Farmers' Bulletin, the demand for which has shown the widespread interest in this subject. Owing to the persistent attempt to acclimatize the Hungarian partridge, which has been imported in very large numbers in the last two or three years, the question of the introduction of this European game bird was made the subject of special investigation, and the results were reported in the form of an article for the Yearbook.

A preliminary investigation of the growth and character of private game preserves in the United States formed the subject of a circular published during the year.

COOPERATIVE WORK.

As heretofore, the Department cooperated freely with various state game officials and organizations. Among the most important features of this work was the assistance rendered the State of Wisconsin in connection with its civil-service examinations for deputy wardenships.

INTERSTATE COMMERCE.

Prosecutions were promptly begun under the new criminal code, effective January 1, 1910, which removed certain technical difficulties contained in the Lacey Act. In this connection investigation was made of certain shipping centers of the Middle West, heretofore the chief field of illegal traffic in game. As a result of these investigations and of the activity of local officials, the situation in this region is now practically under control.

PLUMAGE.

The Department has cooperated with Oregon, California, Missouri, and New York in an effective campaign against the use of plumage of native birds for millinery purposes. The broader question of international cooperation in the protection of the plumage birds of the world is steadily coming to the front. The latest important move is the appointment of an international committee on bird protection by the Fifth International Ornithological Congress, held at Berlin in the latter part of May. Thirteen countries are represented on this committee besides the United States, one of whose two representatives is an official of this Department.

BIRD RESERVATIONS.

During the year an inspection was made of several of the bird reservations by officers and agents of the Department. Wardens for sixteen reservations were appointed, and several of these were assigned the duty of studying special phases of bird life. Serious depredations on the Hawaiian Reservation were reported to the Department, and by arrangement with the Secretary of the Treasury a revenue cutter was dispatched to the scene in January. Twenty-three poachers were arrested on Laysan and Lisiansky islands, and 259,000 wings and a large quantity of other plumage were seized. The poachers were brought to Honolulu and were given a nominal sentence, proceedings being at once instituted against their employer.

NATIONAL BISON RANGE.

Thirty-seven pure-bred buffalo, most of them from the estate of C. C. Conrad, at Kalispell, Mont., were placed on the Montana Bison Range. An increase of eleven calves during the season raised the total number of the herd to 48. In addition to the buffalo, several white-tailed deer, presented by the city of Missoula, were placed on the range.

DIVISION OF ACCOUNTS AND DISBURSEMENTS.

While the appropriations for the Department of Agriculture for the fiscal year 1910 were not much larger in the aggregate than those for the fiscal year 1909, the work of the Division of Accounts in connection with the disbursements for the later year was materially increased by reason of the fact that the appropriations for 1910 were divided into a great many more subappropriations, each necessitating the keeping of a separate account, than were the appropriations for 1909; in fact, the number of the 1910 subappropriations exceeded by approximately 150 per cent the number of the 1909 subappropriations.

During the year there were received, audited, and paid 56,415 accounts, amounting to $10,389,784.78, exclusive of approximately 48,584 accounts of the Forest Service, which received an administrative examination in the Division. Of these accounts, moreover, 4,828 were so-called "combined" accounts, in connection with which there was probably a saving of at least 24,140 checks, to say nothing of the saving of other clerical labor in connection therewith. There were also audited and sent to the Treasury for payment 1,473 accounts. In the payment of the accounts settled directly by the Division of Accounts it was necessary to draw 104 requisitions on the Treasury and subtreasuries and issue 108,757 checks. There were issued during the year 22,803 requisitions for supplies, 6,657 letters of authorization for travel, 32,418 requests for passenger travel, 553 requests on the Quartermaster-General for the transportation of government property, and 2,626 department bills of lading, while 87,500 letters were written or received in the ordinary transaction of business.

To carry on the work of the Department of Agriculture during the fiscal year ended June 30, 1910, Congress appropriated the sum of $17,029,036, an increase of $965,930 over the preceding year. Of this appropriation $12,225,036 covered the ordinary expenses of the Department, $3,000,000 the permanent annual expense for meat inspection, $1,344,000 the agricultural experiment stations, and $460,000 the printing and binding done under the Public Printer.

The disbursements of the Department for the fiscal year 1910 amounted to $13,794,231.97, and the greater part of the balance of $1,676,402.19 will be required for the settlement of outstanding liabilities. The apparent excess of disbursements over the appropriations for this fiscal year is due to unexpended balances brought forward from "Administration, etc., Forest Reserves," and other special appropriations.

The amount for rent of buildings in the District of Columbia for the several branches of the Department was $72,645.

All accounts for the fiscal year 1908 having been settled, the unexpended balance of appropriations for that year, amounting to $442,538.63, was covered into the Treasury on June 30, 1910. The account for the fiscal year 1909 is still open.

The amount estimated for the fiscal year 1912 in the annual estimates for the regular appropriation bill is $16,693,686, which includes $1,440,000 for agricultural experiment stations and $400,000 for the enforcement of the so-called insecticide act of April 26, 1910. In addition there will be a permanent appropriation of $3,000,000 for meat inspection and $460,000 for printing and binding to be done under the Public Printer, making a grand total of $20,153,686.

The following are the more important points wherein the estimates for the fiscal year 1912 differ from the appropriations for the fiscal year 1911:

(1) In compliance with the provisions of the act making appropriations for the Department of Agriculture for the fiscal year ending June 30, 1911, requiring that detailed estimates shall be submitted for all executive officers, clerks, and employees below the grade of clerk, 2,989 employees, whose salaries aggregate $3,221,930, have been transferred from the lump-fund appropriations to the statutory rolls of the various Bureaus, at the same rate in each instance. The lump-fund rolls have been reduced accordingly, with the exception of the permanent appropriation "Meat Inspection, Bureau of Animal Industry," from which appropriation 543 employees, aggregating $480,020, have been transferred to the statutory roll, but the lump fund for meat inspection has not been reduced, as it is a permanent appropriation and as additional money is needed for meat-inspection work.

(2) An estimate of $65,000 is submitted under the Bureau of Animal Industry for the purchase of land for animal quarantine stations at the ports of Baltimore and Boston and for making improvements thereon.

(3) Under the Forest Service, the appropriation for Improvement of the National Forests has been consolidated with General Expenses. The provision under Forest Service in connection with refunds has been broadened to cover certain cases which the Comptroller of the Treasury has decided can not be refunded under the present law. The separate appropriations for the various National Forests have been discontinued and an estimate submitted for each of the six districts in which those forests are embraced.

(4) Under the Office of Experiment Stations there has been included in General Expenses the regular appropriation of $720,000 under the Adams Act, the Comptroller of the Treasury having held that the permanent appropriation therefor expires by limitation with the close of the fiscal year ending June 30, 1911. A new item for a Journal of Agricultural Research, $20,000, is submitted.

By the terms of General Order No. 138, dated January 15, 1910, the Secretary of Agriculture placed the disbursing and accounting work of the Forest Service under the immediate supervision and direction of the Chief of the Division of Accounts and Disbursements, who also received authority to make, subject to the approval of the Secretary, such changes in the methods of accounting and disbursing in the Forest Service as might be deemed necessary from time to time. By the same order the fiscal agents of the Forest Service, both in Washington and at the district centers in Missoula, Mont., Denver, Colo., Albuquerque, N. Mex., Ogden, Utah, San Francisco, Cal., Portland, Oreg., and Madison, Wis., were made subject to the

instructions of the Chief of the Division of Accounts in all matters pertaining to accounts and disbursements. The Agricultural Appropriation Act of May 26, 1910 (36 Stat., 416), supplemented the Secretary's action by transferring these fiscal agents from the Forest Service to the statutory roll of the Division of Accounts and Disbursements, thus completing the change which places the Forest Service on an equal footing with the other Bureaus in regard to fiscal matters and brings its accounting and disbursing work under the immediate supervision and direction of the Chief of the Division of Accounts and Disbursements, who is by statute the administrative officer of the fiscal affairs of the Department of Agriculture.

DIVISION OF PUBLICATIONS.

The publication work of the Department exceeded that of any previous year, comprising 1,982 different bulletins, circulars, and reports, of which 25,160,469 copies were printed for distribution to farmers in every section of the United States. This was an increase of 46⅔ per cent in the number of publications issued, and 41 per cent in the number of copies distributed, and this result was accomplished without any increase in the appropriation or in the force engaged in the execution of the work.

The publications give the results of investigations by scientists of the Department in their various lines of work. The popular bulletins and circulars give in plain language detailed information in regard to every phase of agriculture. The aim has been to meet the popular demand for information on any particular subject by publishing a bulletin or circular, in other words, to give the people, particularly the farmers, the information they desire and which they have a right to expect from the Department, which was founded and is supported for their benefit. Unfortunately the funds for printing are not sufficient to procure enough publications to fully supply the demand. Congress has, however, wisely provided a way by which applicants may always obtain publications after the Department's supply is exhausted and no funds are available to secure additional copies, and that is by purchase from the Superintendent of Documents, under the law of January 12, 1895. During the year that official sold 147,327 documents of this Department and received therefor $18,398.18, the average price per copy being 12½ cents, being an increase of $2,005.08 over the sales during the previous year. Within five years the number of copies sold has increased over 205 per cent, while the amount received has increased more than 240 per cent. It is evident, therefore, that there is an increasing willingness on the part of the people to purchase the publications after their free distribution is no longer possible. A very good illustration is found in the sale of 47,148 copies of a Farmers' Bulletin on "Economical Use of Meat in the Home" after 900,000 copies had been distributed free.

FARMERS' BULLETINS.

Farmers' Bulletins continue to be in great favor with the people. The number of copies secured with the appropriation of $125,000 was 9,337,500, the average cost per copy being 1⅓ cents, as against 7,755,000 during the preceding year. The decision to reduce the size has made it possible to procure more copies. Forty-five new Farmers' Bulletins were issued during the year, of which 2,915,000 copies were printed, while the reprints of older bulletins still in demand aggregated 6,422,500 copies. The congressional distribution amounted to 6,449,589 copies.

The demand for these bulletins from educational institutions is increasing and is far in excess of the Department's ability to supply. On account of the elementary character of the bulletins they are considered suitable for text-books in schools of all grades, and such use of the information acquired by the Department should be encouraged. The inevitable result would be a tendency to increase interest in agriculture in the minds of the young, which would influence them to remain on the farm. With the present appropriation, however, it is not possible to fully comply with requests received from this source. It is a subject with which Senators, Representatives, and Delegates in Congress are familiar, and it will no doubt receive their serious consideration in connection with the appropriation for printing for the next fiscal year.

SCIENTIFIC AND TECHNICAL PUBLICATIONS.

Our scientists are constantly making new discoveries, which are given to the world in carefully prepared bulletins, for the printing of which $83,116.70 was expended, the number of copies of such publications aggregating 350,000. These bulletins were distributed to selected lists of instructors and to libraries both in this country and abroad, and constitute a permanent record of the achievements of the Department in scientific research. Instructions for applying and utilizing the results of scientific investigations are given in the smaller, popular publications, especially the Farmers' Bulletins, millions of which are annually printed and distributed.

ADMINISTRATIVE PUBLICATIONS.

With the growth of the Department there has been a corresponding increase in what may be called administrative publications, comprising reports required by Congress, for the printing of which $78,726.37 was expended, and food-inspection decisions, notices of judgment, and other documents for the guidance of employees and for the enforcement of laws, including also the necessary blanks for the transaction of the public business.

The great volume of the publication work of the Department, far exceeding that of any previous year, has been secured with an expenditure of $441,349.94 for printing and binding. Inasmuch as one of the functions of the Department is to disseminate the information it acquires, and since publications constitute the most effective medium of distribution to the people, the expense of such work is believed to be fully justified. The fact that the results were achieved at a saving to the Government bears testimony to the careful supervision given to this important branch of the work of the Department.

BUREAU OF STATISTICS.

The most important duty of the Bureau of Statistics is to estimate the acreage of various crops at the beginning of each season, their condition at monthly intervals during the season, and the production after the harvest is gathered. Regular reports are made for the first of each month in the year, except February—eleven regular reports. In addition, reports on cotton are made for the 25th of May, June, July, August, September, and November, the last being the estimate of yield.

These reports are estimates based upon replies sent in by many thousands of voluntary but regularly constituted crop correspondents in answer to inquiry schedules sent out by the Bureau. During the year the schedules sent out for the regular monthly crop reports averaged about 65,000 a month, and the replies about 46,000 a month, each schedule having an average of about 40 questions. The schedules devoted exclusively to cotton averaged about 15,000 for each of the six months in which they are sent out, and the replies averaged 10,000. The tabulating, collating, and digesting of these replies involves an immense amount of work, and the amount is growing greater each year, as the work expands.

During the year several new lines of inquiry were added to the regular work of the crop-reporting service and some changes were made. In September, 1909, an estimate of the quantity of barley left on farms from the preceding year's crop was asked. The weight of wheat, corn, and oats was asked in November instead of December, and the weight of barley was added to the inquiry. The production of rice was asked in December instead of November, and the acreage of rice harvested was asked for the first time. Beginning in February, 1910, a special schedule has been sent out monthly inquiring the prices of a large number of farm products, in addition to the regular monthly inquiry concerning the prices of the staple crops and produce. In March, for the first time, the stocks of barley on farms was asked, as well as the percentage of the barley crop shipped out of the county in which grown. In April the mortality of spring lambs from disease and exposure was asked for the first time. The cotton schedules during the crop season of 1910 have contained an inquiry

concerning the condition of the crop compared with condition on the same date last year, this in addition to the usual inquiry as to condition compared with a normal.

Several special inquiries were made during the year, as follows: (1) Stocks of potatoes in hands of growers and in hands of dealers on January 1, 1910. (2) Causes and extent of deviation from a normal production of various crops. (3) Monthly marketings by farmers of wheat, corn, oats, barley, flax, and hay.

The crop-reporting service is now giving general satisfaction. There has been practically no adverse criticism of our estimates during the year.

In addition to the present work of promulgating figures representing the condition of growing crops from month to month, it is contemplated during the present year to have the Crop Reporting Board give each month its estimate of the volume of the year's final production, as indicated by the condition figures. In other words, the condition figures will be interpreted in terms of yield.

When the figures of the new census are available the estimates of this Department relating to total acreage and production for each crop in each State for 1909 will be adjusted to conform to the census figures. The acreage estimates for 1910 will also be revised, using the census figures for 1909 as the basis. This will give us a new basis for our annual estimates, to be used until the next national agricultural census is made.

Aside from the crop reports, several important studies were made in the Bureau during the year. The prices of beef and pork were investigated, to ascertain the difference between the wholesale and retail prices in many cities. In connection with this study, the changes in prices of many farm products were examined for the period beginning with the low prices of the industrial depression of 1893–1897.

A report on the marketing and transporting of grain in the region of the Great Lakes, made toward the close of the fiscal year, treats of the reduction in the cost of sending grain to market and the increased quantities handled during the last quarter century.

Preliminary work was done on an investigation to show the conditions affecting the cost of selling and delivering grain and live stock in the Pacific Coast States.

The nineteenth investigation of the wage rates paid to farm labor was well advanced at the close of the year. This inquiry has included many items of supplementary wages, such as house rent, firewood, and laundry work, often not considered in studies of money wages. The cost of living of the farm laborer, compared with that of employees in the cities, has also been considered as affecting his real wages.

A study of the dates of planting and harvesting crops throughout the world has been under way during the year, with the cooperation of many experts in other branches of the Department, and gives promise of interesting results.

LIBRARY.

Like everything else about the Department, the Library is for service, and as a reference library its first duty is to the Department's employees. But it is also able to aid the scientists in the agricultural colleges and experiment stations, to whom it made 548 loans of books from its shelves, which is a slight return for the many favors and benefits which scientists connected with the Department have enjoyed through the generous policy of other libraries in lending books for use in the work of the Department, amounting to 4,701 volumes.

The accessions of books, pamphlets, and maps totaled 8,156, of which 3,646 were gifts, making the total number of recorded books and pamphlets available for use of investigators 109,630.

The increasing interest in agricultural libraries and agricultural literature on the part of librarians and their efforts to serve the farmer is worthy of note. At the seventh annual meeting of the League of Library Commissions, held in connection with the American Library Association Conference at Mackinac Island, June 30, 1910, one session was devoted to the general subject of commission work with the farmer, and it is hoped that a permanent agricultural libraries section will be formed, which will be the means of bringing about closer cooperation among agricultural libraries, of furthering their advancement, and of stimulating interest in agricultural literature.

OFFICE OF EXPERIMENT STATIONS.

RELATIONS WITH AGRICULTURAL EXPERIMENT STATIONS.

The sixty-two agricultural experiment stations in the several States and Territories have been actively at work in the interest of the farmers and horticulturists during the past year. Fifty-five of these stations receive appropriations provided for by acts of Congress, which amounted to $1,344,000 for the fiscal year ended June 30, 1910. The state legislatures made appropriations for their work amounting to over $1,000,000, and additional sums were received from fees for analyses of fertilizers, sales of farm products, and other local sources aggregating about $750,000. The total annual revenue of the stations is now over $3,000,000, as compared with half that sum in 1905.

In 1906 Congress passed the Adams Act, by which the stations were granted additional funds from the National Treasury. Under the terms of this act this grant was to be increased annually for five

years. The maximum has now been reached and the stations will receive $720,000 under the Adams Act during the current fiscal year. The liberal policy of Congress toward the stations has resulted in much larger appropriations by the States and a material increase of their revenues from other sources. The Adams fund is restricted in its use to original research. The state funds are mainly used for the more practical work, including the maintenance of substations, demonstration fields, agricultural surveys, and a great variety of local experiments, as well as for printing and disseminating the results of the experiments. By this cooperation of the National and State governments in fostering the stations, their operations have been greatly strengthened and the results of their work have been brought more directly to the attention of the farmers in every part of the United States.

The Adams Act has enabled the stations to attack a large number of the more fundamental and difficult problems of our agriculture. The scientific work of the stations has been greatly broadened and increased in efficiency. A much more solid foundation on which to base a rational practice of agriculture is thus being established. According to the Comptroller's decision the appropriations under the Adams Act were limited by the terms of the act to a period of five years. It will therefore be necessary for Congress to take further action if the stations are to continue to receive this needed increase. It is believed that the appropriation is of great importance to our agriculture and that without it the work of our stations would be seriously crippled. I have included it in the estimates submitted for the ensuing fiscal year.

The stations annually issue about 500 publications, which are regularly sent to over 900,000 addresses, mainly those of farmers. The practical results of station work are also widely disseminated through the public press. They are carried out to the farmers through the farmers' institutes and other forms of extension work conducted by the agricultural colleges and the state departments of agriculture. While the task of effectively reaching the many millions of our rural people with information which may lead to the improvement of agricultural practice is an enormous one and will not be thoroughly performed for many years, great progress has been made in this direction during the past decade. The efforts of the stations in the dissemination of information have been mainly spent in popularizing their work and their funds for printing are still inadequate to meet the growing demands of our agricultural people.

Meanwhile less attention has been given to the appropriate publication of the scientific work of the stations. This material has either been combined with the practical in popular publications, or issued in separate series, or published in abbreviated form through scientific journals. Recently there has been a growing tendency to

publish such material in foreign journals in the belief that thus it is more surely brought to the attention of the scientific world.

The general result of the present method of publication of the scientific work of our stations is very unsatisfactory and from the standpoint of National pride even humiliating. We have the most comprehensive system of agricultural research in the world. The amount and value of the scientific work of the stations, on which their practical results are based, are very great, yet the scientific publications of our stations are so fragmentary and scattered that it is very difficult even for workers in similar lines in this country to obtain them in any complete way, and to the great world of science they are largely unknown. To remedy this defect and put the scientific work of the American stations in the right light before the world the Association of American Agricultural Colleges and Experiment Stations has asked my cooperation in laying before Congress a proposition to establish under National authority a central medium for the publication of original reports of the scientific work of the stations. Believing that this is a matter of much importance and that it is worthy of careful consideration by the Congress, I have included an item proposing an appropriation for this purpose in the estimates for the ensuing fiscal year.

In the conservation of our natural resources the experiment stations are doing very important work. The greatest natural resource is the productive power of the soils, and the stations throughout the country are making every effort to devise efficient means for the maintenance and increase of the fertility of the land. The investigations in progress include studies of all problems bearing on this point, such as the economic use of fertilizers, the retention of the proper quantity of moisture by the soil and its use by the growing crop, rotative cropping, green manuring, especially with leguminous plants, the action of bacteria in relation to soil fertility, etc. The different types of soils are studied in regard to the reduction of fertility by cultivation, and many interesting and valuable facts are being brought out. To give an instance of this kind, the Nebraska station found that the cultivated loess soils of the State contained as much phosphoric acid, potash, and lime in the surface as in the subsoil, but that the content of nitrogen, humus, and unhumified organic matter decreases rapidly from the surface downward. This indicates that the maintenance of fertility in so far as chemical composition is concerned is essentially a matter of keeping up the supply of total organic matter.

The extent to which some of the experiment stations are extending their work throughout their States is illustrated by one station, which has two regular substations, and the management of twenty-five county and asylum farms used for experiment and demonstration purposes, had the past year 1,600 centers where its pedigreed barley was being grown for breeding and increase, and over 20,000 boys

growing corn and barley for prizes. Among the prizes are scholarships covering all the expenses of a week's attendance on a young people's corn and grain course at the college, 20 boys receiving such prizes and attending the course last year.

More attention is being given from year to year to crop production under dry-farming conditions, which is essentially a matter of moisture conservation. The stations have done valuable work along this line, and in many States this is given recognition by the establishment and maintenance of dry-farming experiment stations at the expense of the State, but under the general direction of the central station receiving the Federal funds. In many instances the work of these dry-farming stations is carried on in cooperation with this Department. This work is doing much to put farming in the dry regions on a safe and enduring basis.

The New Jersey station has shown that nonleguminous plants, such as corn and cereals, grown in close association with legumes, benefit in some manner by the nitrogen-fixing ability of the legumes. This benefit is quite marked; but the channel through which it is exerted has not yet been determined.

The experiment stations in several States are supplementing and extending the Department's work on hog-cholera vaccine by testing its use extensively and manufacturing it for distribution under state funds.

Work at one station for nine years has demonstrated wide rations to be more profitable and economical for dairy cows than the theoretical narrow ration, and this conclusion is confirmed by extensive investigations at the Minnesota station, where the health and production of cows from calfhood has been studied and checked by laboratory examinations.

The extensive dairy investigations carried on by the Missouri station in cooperation with the Department have thrown much light on the efficiency of food in milk and butter production.

The rôle of bacteria in relation to the keeping quality of milk and butter has been investigated with great thoroughness at the Michigan station, and many facts have been established which have an important bearing upon practical dairy methods. Most interesting facts have been brought out in these investigations with reference to the varying behavior of the organisms found in milk and butter when working alone or in association with one another and in their resistant power under different conditions. It has been shown that a large proportion of the harmful organisms succumb to ordinary sanitary dairy methods; but one group has been isolated and studied which not only survives but is active in a 12 per cent salt solution at $-6°$ C.

The Iowa station, among other things of immediate practical value, has shown the expensiveness of condimental foods as compared with

standard feeds of equal nutritive value and the danger of the formation of urinary calculi in long-continued feeding of roots to breeding sheep. This station has also demonstrated a number of efficient substitutes for oats in rations for horses.

In pollination experiments with apples at the Oregon station only 15 out of 87 varieties were self-fertile, and the self-fertile varieties were improved in size by cross-pollination. A number of suitable pollenizers for commercial varieties of apples have been determined. The possible variation of the same kind of fruit grown in different climates is indicated by some work recently reported by the Massachusetts station, where Ben Davis apples from various sections of the United States and Canada were collected and studied. Generally speaking, this variety gradually becomes more elongated in form the farther north it is grown. Upon correlating the variations in fruit characteristics with the variations in meteorological data, it appears that the poor quality of the northern-grown Ben Davis is due to an insufficient amount of heat to fully develop the fruit. Apple orcharding in the New England States has recently been given marked attention by the stations, with a view of extending the industry through improved methods of culture, harvesting, packing, grading, and cooperative marketing, so successfully employed in the apple district of the Northwest.

Considerable work has been done at both the South and North Carolina stations leading to a better knowledge of the Scuppernong and other Rotundifolia grapes which are found to be especially adapted to the climatic and soil conditions of the Coastal Plain region from southeastern Virginia to Texas. Demonstrations conducted at the South Carolina station have shown that the injurious results which have often followed the pruning of these grapes can be avoided if the pruning is done not later than the months of October and November. Extensive experiments made at the North Carolina station lead to the conclusion that the important varieties of Rotundifolia grapes are self-sterile and that to insure regular crops a sufficient number of staminate, or male, vines must be planted in the vineyards.

At the New York state station a new disease of cucumbers and muskmelons in the greenhouse was worked out and its cause determined. The fungus has since appeared upon tomatoes both in this country and in Europe. In cooperation with the Vermont station, the pathogenicity of the organisms causing the soft rots of a number of fruits and vegetables has been thoroughly worked out.

At the Arizona station it has been found that date ripening may be hastened by spraying the immature fruit with a solution of acetic acid, thus causing choice varieties to ripen in that region. This station has also shown that many varieties of olives, when grown

under Arizona conditions, are well adapted to oil making and that when properly made from them the oil may be of the very finest quality. The recoverable oil content of the Arizona olive compares favorably with that of the California olive.

The Florida station has studied the effect of fertilizers upon the quality of pineapples. In general it has been found that the eating quality of pineapples, so far as their sugar and acid content is concerned, does not appear to be affected by the kind of fertilizer used, although their shipping quality may be thus influenced.

The Massachusetts station finds that many of the more serious diseases of greenhouse crops are due to faulty environment and can be successfully controlled by proper regulation of the heat, light, humidity, circulation of the air, and condition of the soil. If this is skillfully done spraying greenhouse crops is considered wholly unnecessary.

THE AGRICULTURAL COLLEGES AND SCHOOLS.

The growth of sentiment in favor of elementary and secondary as well as collegiate instruction in agriculture has been more rapid than even the most sanguine friends of agricultural education had anticipated. Since October, 1908, the number of institutions in the United States giving instruction in agriculture has increased from 545 to 875, or more than 60 per cent in nineteen months.

The most notable advance in secondary agricultural education was in the number of departments of agricultural instruction established in public high schools with the aid of state appropriations. Five such departments were established in Alabama high schools, 8 in Louisiana, 10 in Minnesota, 5 in Mississippi, and 10 in Virginia. The importance attached to these new departments is indicated by the fact that in many instances the schools adopted the names of the departments and were called agricultural high schools.

There has also been a notable increase in the number of institutions conducting teacher-training courses in agriculture. The total number of such institutions is now 214, including 30 land-grant colleges, 156 state and county normal schools, and 28 negro schools. Nineteen of the land-grant colleges offer regular courses for teachers of agriculture and 24 of them conduct summer schools for teachers. This general movement for the training of teachers of agriculture is significant of the importance now attached to the agricultural education movement.

The agricultural colleges have had a successful year and a large attendance of students. Their graduates have quite generally chosen agricultural pursuits, and have found no difficulty in securing employment. As an indication of this, 30 of the 38 graduates of the animal husbandry course in Iowa State College will engage in farming, 4

will teach in agricultural colleges, and 1 will go into agricultural journalism. Only 3 of these graduates were looking for positions at commencement time and these wanted to become farm managers.

The fourth session of the Graduate School of Agriculture was held at the Iowa State College, Ames, Iowa, in July, 1910. The enrollment was larger than at any previous session and the interest manifested by the students has never been surpassed. There were 207 students from 39 States and the District of Columbia and 6 foreign countries. Eight general lines of instruction were given and important conferences on agricultural extension, agricultural journalism, and elementary and secondary instruction in agriculture were held. The faculty numbered 57, in addition to 17 speakers at special conferences. Eleven members of the faculty were from this Department and the Director of the Office of Experiment Stations was dean of the graduate school.

FARMERS' INSTITUTES AND AGRICULTURAL EXTENSION WORK.

Farmers' institutes are now organized in every State, with responsible directors in charge and a corps of teachers aggregating over 1,000 specialists to give instruction. There was appropriated for carrying on the work last year about $432,000, an increase of $86,000 over the appropriation of the year before. There were held 5,651 regular institute meetings, composed of 16,586 sessions of one-half day each, with a total attendance of 2,395,908. In addition to carrying on the work of the regular institutes the States have been maintaining numerous special meetings of institute character. Several of these special forms of activity are rapidly becoming of such importance as to require separate organizations specially equipped for the service that each interest requires. One of these special forms is the movable school of agriculture. Ninety-nine of these schools were held last year, with an attendance of 65,977.

Field demonstrations also are rapidly coming into use as methods of teaching agriculture to farming people. One State reports having held 67 of these demonstrations, with a registered attendance of 21,775 persons. Others have held meetings of similar character with great advantage. The agricultural train is another form of institute activity that has recently developed and promises to be an effective means for disseminating agricultural information. Twenty-eight trains are reported to have been run during the year by 18 States, with an attendance of 189,645.

Fifteen States held 444 institutes for women, with an attendance of 4,850. Institutes for women, because of their importance, ought to have and doubtless will receive much recognition in future extension work, and institute workers should devote themselves with as great earnestness and energy to the development of this form of

extension activity as they have exhibited in developing institutes for men.

One hundred and sixty sessions of institutes for young people were held, with an attendance of 21,422. When it is considered that 94 out of every 100 children finish their education with the district school, and that the large majority of these do not continue beyond the sixth grade, it is important for the future of agriculture that opportunity be given for young people who live in the country and have left the public school, and from whose ranks the future farmers and their wives must be supplied, to be taught the latest and most improved methods for conducting agricultural operations. Hitherto the large majority of young people in the country over 14 years of age have been without means of instruction along agricultural lines. To supply this need the farmers' institute authorities in a number of the States have organized institutes for youth between the ages of 14 and 19 years who have left the public schools and are about choosing a life pursuit. These institutes differ from boys' and girls' clubs as organized by the public schools in that they are officered by adults, and their instructors are capable specialists of the same qualifications as those who lecture before the farmers' institutes for adults. The instruction also is altogether vocational, and is intended to show how to make money in the business of agriculture.

The agricultural colleges and experiment stations have continued to aid the institutes by detailing members of their faculties and station staffs for lecture service. Four hundred and eighty of these lecturers, representing the agricultural colleges and experiment stations in 43 States, were engaged in institute work last year. Thirty-nine of these States report the days of service contributed by the lecturers at 4,780—a much larger contribution of time by these institutions to institute work than during any previous year.

THE DEPARTMENT'S INSULAR AGRICULTURAL EXPERIMENT STATIONS.

The policy of conducting investigations looking to the diversification of agriculture has been continued as before. Each station has its special problems, and satisfactory progress has been reported on the various lines of work.

In Alaska a demonstration is being made of the possibilities of agriculture in that region. Cereal breeding, testing of varieties of grain, methods of culture, and the introduction of new varieties of grains and forage plants are made the important investigations at the Rampart and Fairbanks stations, and it is gratifying to note the success attained at the Rampart station in the introduction of hardy early-maturing varieties of barley, oats, winter wheat, and winter rye. In addition, by cross-fertilization a number of new varieties of barley and oats have been developed, some of which were grown

this year for the first time. About 65 acres were cropped this year, and data are being collected to show the possibility of farming in the Yukon Valley. The first self-binding reaper in Alaska was sent to the Fairbanks station this summer. With the success thus far indicated a demand has come for information regarding agricultural lands, and a reconnaissance is being made of a number of regions preliminary to a detailed land survey by the Department of the Interior. The horticultural investigations are being extended, and the plant-breeding work is beginning to give results. Of the large number of hybrid strawberries made at the Sitka station at least a score have proved thoroughly adapted to the coast region of Alaska. They are hardy, prolific, and the berries are of large size, good substance, and excellent quality. The stock-breeding work at Kodiak has been extended to include sheep. Forty Cotswold-Merino ewes and two Lincoln rams have been purchased for the station, and the success of this experiment is awaited with interest. If sheep can be successfully wintered, there are large areas in Alaska adapted to their production. Experiments with some of the hardy breeds from Scotland and Iceland are contemplated if the preliminary trials prove successful. The Galloway cattle continue to give satisfactory results at Kodiak, and at the end of the fiscal year the herd consisted of 61 pure-bred animals of all ages.

Great interest has been aroused in Hawaii by the cotton experiments inaugurated by the station, and the growing of cotton in commercial quantities appears to be assured. The cotton plant requires less water than sugar cane, and already over 500 acres of cotton have been planted on sugar plantations where irrigation water was deficient. Sea Island and Caravonica varieties are the chief ones used, and their cultivation as perennials is intended. By pruning at the proper season the time of picking can be made to articulate very well with the cane-grinding season, when there is the greatest demand for labor on the plantations. The adaptability of this crop to the owner of a small tract of land is being demonstrated. Breeding experiments with cotton are being continued, and by vegetative propagation some desirable strains are being rapidly developed, without the possibility of undesirable crosses through pollination. The investigations on rice have resulted in some new varieties produced by breeding experiments that exceed any in common use. They have also shown the value of ammonium sulphate as a fertilizer for the rice crop. The visit of the agronomist to Japan last season resulted in the introduction of a number of newly-developed varieties of rice, some of which appear very promising. The pineapple soil studies have been continued, and it has been found that where the manganese content is not too high the use of suitable fertilizers will correct the injury due to manganese. A more serious pineapple trouble in Hawaii has been found, due to

a lack of aeration of the soil, and studies to correct this condition are in progress. A study of the pineapple fruit has shown the influence of ripeness on the sugar content. There appears to be no increase in the amount of sugar in a fruit after it is cut, although the fruit will become yellow and soft, hence the importance of the stage of maturity on the quality of the fruit. The rubber-tapping experiments have been continued, and the profitableness of growing Ceara rubber has been shown. In connection with the rubber investigations it has been found possible to keep down all weed growth by spraying between the trees with arsenite of soda. A demonstration on 400 acres showed the success of the treatment at the low cost of $1.25 per acre.

In Porto Rico one of the most striking results of the investigations during the past year was the determination of the cause of the chlorosis in pineapple plants. This rather serious trouble was found to be due to the abundance of calcium carbonate in the soil, and it was found inadvisable to plant pineapples on soils containing more than 5 per cent of calcium carbonate. The work on sick soils, due to superabundant bacteria, has been continued, and disinfection by chemicals or by frequent deep plowing has proved of value in correcting the trouble. The rapidly developing citrus industry has necessitated much attention to the insect and fungus pests of these crops, and some of the results of the investigations have been issued. The great importance of windbreaks in connection with citrus growing in Porto Rico has been fully demonstrated. Studies are being made of the pests of other economic plants, especial attention being given to those occurring on coffee. The experiments on the introduction and cultivation of some of the more valuable coffees of other regions have been continued, and the station is distributing for planting limited quantities of five of the highest-priced coffees of the world. Of some of these, three-year-old trees bore this year more than a pound of clean coffee to the tree. The flavor and aroma, so far as tested, have been pronounced equal to the original stock. The work of the station on the importation and breeding of live stock has been very successful and some results are being shown. The progeny of American saddle-bred horses bred to native mares have matured into handsome animals that command very high prices. Crossbred zebu bulls and woolless sheep have been introduced and have developed splendidly. They will be used to improve the cattle and sheep stock of the island. Similar work is being carried on with swine and poultry, and the station's excess stock of all kinds is in great demand by planters and breeders. The cooperative work with planters and with the insular authorities has been extended, and the relation of the station's work to the island's development is becoming well recognized and appreciated.

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The agricultural experiment station of Guam now has a permanent location, the negotiations for its purchase having been completed during the year. Much progress has been made in bringing the land under cultivation and in the erection of necessary buildings. The greater portion of the land has been planted to forage crops of various kinds preliminary to experiments in the introduction and breeding of live stock. The experimental work undertaken has been of the simplest kind, and ocular demonstrations are being made of the value of improved varieties of standard crops, the introduction of others, and the necessity for better methods of cultivation of all crops. Some of the introductions have proved of great value and readily adapted to their new location. Among those with which the most striking results have been obtained are Kafir corn, sweet potatoes, avocados, and pineapples from Hawaii, guinea grass, and the large water grass, *Paspalum dilatatum*. All of these thrive well and have proved very satisfactory, and they are being distributed for planting as rapidly as possible. A number of crops have been found to ratoon or sucker after the plants are cut, and advantage is taken of this to grow some of them as perennials, although they are usually grown as annuals. Various leguminous plants have been introduced; among them cowpeas, velvet beans, soy beans, and peanuts seem quite promising. A demonstration of the value of these crops in enriching the soil is in progress. Attention is being given to the cultivation of maize, considerable of that crop being already grown and consumed in Guam. Comparisons are being made of varieties, and studies are in progress to determine a practical method of storing this and other grains against the losses due to weevil, fungi, etc. For the short time the station has been established it has interested the people and gained their confidence to a remarkable extent. They are desirous of obtaining seeds of plants whose value they can see. Especially noteworthy is the interest taken in new implements and methods of culture. A small cultivator attracted attention, and through our special agent a number were secured and sold to farmers at cost. With one of these cultivators a man with the aid of a carabao can cultivate as much land as would require ten men with their old implements. The willingness of the people to abandon their old conservatism in this regard appears to augur well for the future influence of the station in restoring and developing agriculture on the island of Guam.

NUTRITION INVESTIGATIONS.

The investigations in human nutrition carried on in the Office of Experiment Stations were instituted in 1894 at the time when the agricultural experiment stations in the different States were authorized by Congress to cooperate with the Secretary of Agriculture in

studying the food and nutrition of man. For a number of years the investigations involved cooperation with agricultural colleges, experiment stations, and other institutions, but for the past few years the work has centered in Washington, quarters for it having been provided in the new Department of Agriculture building.

Briefly stated, the purpose of the nutrition investigations is to study various aspects of the problem of the value for human food of agricultural products, both animal and vegetable. In carrying out this project many studies have been made which have to do with the nutritive value of flour and other cereal products, the relative nutritive value of meats of different kinds and cuts, and the value as food of fruits, nuts, and other food products. The ease and thoroughness of digestion of many kinds of animal and vegetable foods have been studied, as have also methods of preparing food for the table and other technical questions and practical problems of general interest.

One of the important features of the nutrition investigations has been the elaboration of methods and apparatus for the experimental study of nutrition problems. Particularly important is the respiration calorimeter, an instrument of great precision, which permits of the measurement of the total income and outgo of matter and energy in the human body and is adapted to the study of a great variety of questions. It should be mentioned that it is useful not alone for studying human nutrition problems, but is equally well adapted to the study of the feeding of domestic animals, as is shown by the results obtained in the cooperative studies undertaken by the Bureau of Animal Industry of this Department and the Pennsylvania Agricultural College and Experiment Station with a respiration calorimeter especially adapted to such work. Indeed, the devising and perfecting of this apparatus may be justly regarded as a very important contribution to general agricultural science.

The respiration calorimeter which has been installed in the new Department of Agriculture building and is being used in the study of the relative ease of digestion of cheese in comparison with meat and of other important questions, has many new features which make for accuracy and ease of operation. It has already been learned from digestion experiments carried on as a part of the nutrition investigations that cheese is digested very thoroughly by the average individual and that it is not a common cause of physiological disturbance, as is often claimed. Results obtained in recent tests with the respiration calorimeter indicate that when eaten in ordinary amounts cheese does not require greater expenditure of energy for its digestion than does meat in comparable quantities, and so it seems fair to conclude from experimental data now available that this food material is worthy to rank as a staple article of diet suitable for use in quantity.

Such a conclusion is of great importance to the American dairy interests, since it has been the American custom hitherto to regard cheese as something to be eaten in small quantities for its agreeable flavor rather than a material suited to form an integral part of a meal. To round out this work with cheese, tests are now being carried on having for their object the accumulation of data regarding its preparation for the table in palatable ways, so that the housewife who wishes to use this food, which supplies such a large proportion of protein and fat at a reasonable price, may have abundant and reliable information as to its possible use as a welcome and integral part of the diet.

It has always been a fact that one of the most interesting features of the Department of Agriculture work is that the Department is so generally regarded as a bureau of information by the people at large. This turning to the Department for information is as marked in the case of nutrition as in other branches of Department work. The number of farmer's wives and other housekeepers and of teachers and individuals who submit their problems to the Department and ask for data and suggestions regarding food, diet, and other home problems is very large and constantly increasing. This means that directly and personally, as well as by means of its publications, experimental work, and its close relations with educational institutions, the Department comes in touch with the people of the United States and is able to demonstrate that its nutrition work is of interest and practical value, as well as of scientific importance.

IRRIGATION INVESTIGATIONS.

During the past year the Office of Experiment Stations, while maintaining most of the old lines of work in its irrigation investigations, has endeavored to modify its plans so as to meet the demands for information on the new issues which are constantly arising.

This is particularly true as regards the assistance which has been given to the new settlers. The task of converting desert land into productive fields is not easy under the most favorable conditions, but when the one who attempts it knows little or nothing about irrigated farming the difficulties are greatly increased. Those in charge of irrigation investigations in the West have, therefore, devoted a considerable portion of their time to advising the newcomers as to the methods best adapted to their individual needs. This personal advice, supplemented by practical bulletins, has done much to prevent mistakes and to safeguard the settler from either partial or total failure.

So widespread an interest has of late been created in the East regarding irrigation in the West that the Department has been flooded with requests for information as to the conditions and possibilities of different districts. The series of bulletins on irrigation prepared by this Department in cooperation with western state engineers and others

has done much to furnish the information desired. Of this series, ten bulletins have already been published and four more are being prepared. When complete, the irrigation conditions as regards the climate, soil, water supply, extent of land, crops, etc., of each State and Territory in the West will be accurately described.

In former days water for irrigation purposes was both plentiful and cheap and in attempting to use it much was wasted. In many parts of the West the old wasteful methods still prevail, although the value of water has increased many fold. The results of seepage measurements of irrigation channels obtained by the Department, coupled with the high price of water rights and the rise in value of agricultural products, have induced many companies to line their main canals. As a result, many channels which formerly lost from 20 to 30 per cent of their total flow are now practically watertight. In many cases such improvements would not have been made if the attention of the managers had not been called by our engineers to the large losses sustained and the best means of preventing this waste. In other cases farmers used large amounts of water without realizing how excessive was the use until measurements were taken. When the irrigators of the San Joaquin Valley in California first began to apply water on what had been dry-farmed grain fields they frequently used over 9 feet. Now about one-third of this amount is found to be ample. The water users of Greeley and neighboring districts in Colorado used to think their crops would burn up unless they had a miner's inch of water to the acre. Now they are raising crops on the same ground that are worth about four times as much with one-fourth the water formerly used. They are learning that cultivation takes the place of irrigation to a great extent.

The demonstration farms established in former years have been maintained. These have been of great value during the past year in showing, among other things, the benefits to be derived from the use of scanty water supplies on small fields in connection with dry farming. At the Cheyenne farm during the past season, 54 bushels of oats were raised per acre with the application of only 8 inches of irrigation water, while the crop grown without irrigation was practically a failure. Alfalfa yielded 4,805 pounds of hay per acre with the application of 13.3 inches, while the unirrigated field yielded only 550 pounds. Beardless barley, with the application of 9.7 inches of water, yielded 31 bushels per acre; that unirrigated and raised on summer fallowed ground yielded only 2½ bushels. At Gooding, Idaho, 8.8 tons of red clover was harvested from land which received only 19 inches of irrigation water. These results show what can be done with a limited supply of water when properly applied.

The need of investigating the questions which arise in connection with the use of water in irrigation is so keenly felt by the people of

the West that several Western States are now cooperating with the Department in the prosecution of these studies. For years the States of California and Utah have given dollar for dollar for the purpose of carrying on this work. The States of Idaho and Wyoming are likewise contributing considerable sums for the cooperative investigation of problems peculiar to these States. In time it is expected that many other States will enter into cooperative arrangements with the Department for the investigation of irrigation problems.

In many sections of Louisiana, Arkansas, and Mississippi the ravages of the boll weevil have made the growing of cotton unprofitable and the producers are substituting other crops. Experiments with the growing of rice have proved that it can be grown there profitably. In consequence, large areas of cotton land have been planted to rice during the past season and costly failures are quite certain to result unless proper methods are followed. These farmers as a rule know but little about pumping plants, the building of levees for rice irrigation, the quantity of water to apply, and the proper time of application. It has therefore been found necessary to detail a man to this field to devote his entire time to a study of rice irrigation and to work out, if possible by experiments, better and cheaper methods than those now in vogue. A Farmers' Bulletin on the irrigation of rice for the benefit of beginners will soon be published.

IRRIGATION IN THE HUMID REGION.

The widespread drought of the past summer throughout most of the humid region has greatly increased the interest in the irrigation of gardens, truck farms, and orchards, and the demands on the one agent we have been able to detail to this work have been far greater than he could meet. The advantage of irrigation as an insurance against the long dry spells for some of the common crops has been brought out in a striking manner on several farms where experiments were conducted this summer. As a result of adding both moisture and fertilizer to the soil on experimental plats in Iowa by irrigating with sewage, the yield of beets was increased one and one-half times, that of timothy was doubled, while the yield of bluegrass was ten times as great as on the nonirrigated plats.

At Neenah, Wis., it was found that irrigation prolonged the bearing season of strawberries ten days and increased the yield 50 per cent. On the same field irrigated carrots yielded 50 per cent and irrigated onions 150 per cent more than the nonirrigated crops.

The utilization of a flowing well at Albany, Ga., in irrigating corn the past season quadrupled the yield, and as the result of an experiment conducted by this Department wells are now being sunk in this district for the irrigation of corn, cotton, and legumes in order to

insure against droughts, to introduce scientific rotation, and to increase the profits from small farms.

DRAINAGE INVESTIGATIONS.

During the past five years the Office of Experiment Stations has made surveys and plans for the improvement of more than 9,000,000 acres by drainage. This has been done at an expense of about 3 cents per acre. When these lands are fully improved and utilized the crops raised on them will annually add many millions to the country's wealth and furnish food for many thousands of men.

OFFICE OF PUBLIC ROADS.

PRESENT STATUS OF ROAD IMPROVEMENT.

By reason of a rather remarkable combination of conditions, the immediate present may be considered the most important period in the history of road improvement in the United States. The old systems of road administration, involving the principle of extreme localization, are fast breaking up, and new systems, involving the principle of centralization, are taking their place. Road administration is, therefore, in a transitional or formative stage, and it is of the utmost importance that the movement be directed along right lines.

It is a curious coincidence that the introduction of the motor vehicle at about the time when these changes in administration began has brought about traffic conditions which have necessitated an equally radical departure from old methods of construction and maintenance. It will thus be seen that the entire subject of road improvement, involving administration, construction, and maintenance, is passing through an exceedingly important period, in which the educational and scientfic work of this branch of the Government service should prove of the greatest value.

OBJECT-LESSON AND EXPERIMENTAL ROADS.

During the past year the Office of Public Roads has continued giving instruction in the methods of road building peculiarly adapted to each locality. This instruction has been given through the medium of object-lesson roads, built at local expense, under the supervision of an engineer from the Office. That results of considerable magnitude have been accomplished under this project is shown by the fact that during the past fiscal year there were completed 1,007,570 square yards of road, equivalent to about 114 miles of road 15 feet wide, as compared with 690,000 square yards for the previous fiscal year. Viewed as a construction record alone, this would constitute an excellent showing, but, when it is considered that this mileage was made up of 55 object-lesson roads, each constituting a miniature school of road building, comprising 10 distinct types of construction, it must be evi-

dent that this feature of the Department's work is a powerful factor in the promotion of the movement for the betterment of the public roads.

It is the practice of the Office to inspect from time to time the various object-lesson and experimental roads, and to ascertain what has been the effect of their construction upon the locality. Last year 22 object-lesson roads, aggregating about 22 miles, were inspected, and it was found upon the actual reports of the local officials in charge that these 22 short sections of road had directly resulted in the building of 730 miles of additional roads according to the same method, and had brought about the expenditure, through bond issues, of $1,500,000.

ADVISORY WORK.

The advisory work of the Office during the year covered a wide field, relating to construction of various types of road, surveys, use of convicts in road work, bridge construction, maintenance, use of the split-log drag, road materials, effect of automobiles on roads, the issuance of bonds for road improvement, the drainage of roads, and other work along similar lines. In all, about 250 assignments were made under this project, showing an increase of about 70 per cent over the amount of work performed during the preceding fiscal year. This is a satisfactory showing, not alone because of the increased amount of work, but because it indicates that localities have come to look upon the Office of Public Roads as a body of consulting engineers and experts who are ready and able to aid them in the solution of their most difficult road problems.

LECTURES, ADDRESSES, AND PAPERS.

The educational work of the Office, including lectures, addresses, and papers, has been greatly facilitated and broadened through an extensive lecture program. These lectures are in almost all cases given by the same men who actually direct the investigative work and the construction and maintenance of the object-lesson roads, and are therefore of a practical, instructive character. During the year 523 lectures and addresses were given throughout the United States, as compared with 185 for the previous year.

INSTRUCTION IN HIGHWAY ENGINEERING.

The Office has greatly enlarged and broadened the project relating to the instruction of engineer students in practical methods of road construction and maintenance. The plan provides for the appointment each year of graduate engineers to the position of civil engineer student. During the first year of their connection with the Office they are given a most thorough training in all branches of the work and in many cases are retained as junior highway engineers. The

Office is in constant receipt of requests from States, counties, and townships to recommend suitable young engineers to take charge of road improvement. During the last year nine engineers, constituting a very considerable percentage of the total number, resigned to take up work in various parts of the country. While the operations of the Office are handicapped to a certain extent by this constant drain, the exact purposes of this course of instruction are thereby served in the highest degree. If a greater number can be appointed and trained each year, the result will in time have a very material bearing upon the progress of road improvement. While the object-lesson road is an excellent example, a capable, progressive engineer constitutes an infinitely greater force in the movement, as he should reasonably be expected to go on year after year adding in a material sense to the efficiency of our road systems. This project should receive greater financial support and the number of appointments should, if possible, be doubled or trebled.

PROGRESS OF ROAD IMPROVEMENT.

The Office is assembling reliable data as to the progress of road improvement in the United States and the relation of roads to agriculture. Through an organization composed of special agents in all parts of the country the Office will soon be in a position to receive prompt reports of progress along all lines. This information will be disseminated in such a way that the work in the various States can be so correlated and coordinated as to minimize the duplication which is now so much in evidence.

TESTING OF ROAD MATERIALS.

In the routine testing and examination of road materials great progress has been made along established lines. The total number of samples tested during the year was 1,168, an increase of 59 per cent over the number received and tested during the preceding year. In addition to these routine tests, investigations were made with a view to the utilization of slag and other by-products in road building, and these were extended to comprise field experiments through the construction of short sections of road at Youngstown, Ohio, and Ithaca, N. Y. These investigations have developed the fact that practically all the basic open-hearth slags are well adapted to road construction, especially when used as binding materials. It has been found that by adding quicklime to blast-furnace slag screenings the cementing properties are greatly increased. These investigations will be continued during the next fiscal year.

CULVERTS AND BRIDGES FOR HIGHWAYS.

The need for better culverts and bridges for our public highways is becoming evident, both from the point of view of economy and

safety for the public. Information on this subject in suitable form has been in the past, and still remains, fragmentary and scattered.

By far the larger number of such structures that are needed are of the shorter spans—50 feet or less—and in the past they have been built of timber, which is, however, constantly increasing in price, and requires a relatively much larger expenditure for maintenance. Much economy can be effected, and more durable and safer structures can be built out of concrete or masonry, provided that the required information and skilled supervision may be had.

Owing to the fact that the individual pieces of work are small, those in responsible charge have not felt warranted in incurring the expense incident to the employment of skilled engineering assistants.

Such information as is referred to above is now being collected, and it is hoped that much of value will be in shape for publication and distribution during the coming fiscal year.

The published information will be supplemented by personal inspection and advice by engineers of the Office when request is made through the local authorities.

INVESTIGATION OF DUST PREVENTIVES AND ROAD BINDERS.

During the past year the work of the Office relative to the investigation of the problems of dust prevention and road preservation has advanced rapidly.

Routine tests or analyses of bituminous road materials made in the laboratories during the past year were more than double the number made during the preceding year. A number of these examinations were made in conjunction with the experimental field work of the Office, and were reported, together with descriptions of the experiments, in Circular No. 92. It is expected that these examinations will be of great service in determining the value of certain classes of binders, as the experimental work is carefully inspected from time to time, and the results are made a matter of record.

Through its laboratory work, the Office has been able to offer valuable advice in regard to specifications for bituminous road binders, and in many instances to frame such specifications upon request of various public-service bodies. A number of the state highway commissions have profited by this opportunity.

Many worthless road preparations have been, and are at present being, manufactured and sold to the public through ignorance on the part of both producer and consumer with regard to the requisite characteristics of such materials to meet local conditions. These materials are sold under trade names and as a rule carry no valid guaranty of quality. Specifications for such materials are therefore much needed for the protection of the public, and this phase of the work will be given continued attention by the Office.

Special investigations of bituminous road materials carried on by the laboratory have covered improvements in the methods of analysis, the effect of various methods of distillation upon the physical and chemical properties of tars, and the development of a test for determining the binding value of bitumens.

CORROSION OF IRON AND STEEL.

The investigations carried on by the Office relative to the corrosion of iron and steel have induced some of the manufacturers to produce a practically pure iron for culverts and pipes. While it is not possible to produce an iron that will be entirely free from rust, yet it is believed that these pure grades of metal are going to give very much better service.

Investigations in regard to fence wire have shown that wire fencing is not only made of inferior material, but that in many cases the galvanizing is put on very thin. Some of the manufacturers have already improved their products in these respects as a result of this work.

The corrosion experiments have been extended to the use of paints in the protection of structures of iron and steel, and as a result of these paint experiments the entire science of protective paints has been placed on a firmer foundation. It is now possible to design and specify a protective paint which will not only cover the metal, but will act as a rust inhibitor. It has been shown that the life of wire fencing can be prolonged by painting it, at an expense of about 1 cent per rod.

OIL-CEMENT CONCRETE.

The Office has conducted important investigative work during the past year in the development of oil-cement concrete. Portland-cement concrete is rapidly becoming a universal building material. The principal objection to the present use of cement concrete is that it is extremely porous and absorbs water. It has been found during the laboratory investigations that it is possible to mingle mineral oils with concrete while it is still wet and before it is laid or molded in the forms, so that the material may thus be rendered waterproof. Several pieces of road surface have already been improved by oil-cement concrete. In addition to this, a bridge surface has been constructed of this material in New Jersey. Up to the present time these surfaces are giving entire satisfaction. Oil-cement concrete is now being given a practical application on a series of new vaults at the United States Treasury. From the results already obtained, the experiments indicate that it would be practicable to use this material for floors, cellars, foundation walls, tanks, silos, manure pits, and similar construction, where strength,

solidity, and waterproof qualities are required. Varying amounts of oil have been used in these experiments, the best results having been obtained when the amount of oil represents about 10 to 15 per cent of the weight of the cement used. The project is yet in an experimental stage and the results obtained should not be considered conclusive.

THE HANDLING OF PERISHABLE PRODUCTS.

It will be observed that more and more attention is being directed to the study of the handling of perishable products, that waste may be lowered and quality and condition improved. Such investigations as have been conducted in California on the handling of citrus fruits and table grapes; in Georgia on the handling of peaches; the handling of poultry and eggs, oysters, corn, wheat, flaxseed, milk, codfish, sweet ciders, etc., indicate the breadth of the work now in progress. The results already obtained show the great value and importance of such studies in the conservation of our finished products—the most valuable asset of any people.

The foregoing is a brief account of what the Department has been doing during the past year to help farmers through research and demonstration. We have been diligent to contribute toward heavier crops, owing to high prices for the necessities of life, and we feel justified in thinking that our efforts and those of the scientists of the States are telling in the grand totals set forth. The day's work on the farm is accomplishing more, and the acre is yielding more. During the past year much attention has been given to demonstration in the field of what is known to advanced students, that men of limited means and circumscribed conditions might learn by object lesson better methods and thereby increase their incomes and also contribute to the magnitude of our crops.

Science that is not applied is dead.

Respectfully submitted.

James Wilson,
Secretary of Agriculture.

Washington, D. C.,
November 23, 1910.

THE MANAGEMENT OF SECOND-GROWTH SPROUT FORESTS.

By Henry S. Graves, *Forester.*

INTRODUCTION.

In the better-settled portions of the Northeast the virgin forests have practically all been cut off or destroyed by fire and the forests are to-day composed of relatively young trees. In some instances, near the older communities, several successive crops of timber have been cut. The term "second growth" is broadly applied to all such young stands, whether they are the first generation after the removal of the original forest or a subsequent one.

In the eastern hardwood region the trees composing the second growth are very largely sprouts which have sprung up from the stumps of the old trees. (Pl. I, fig. 1.) This is particularly true in the Northeast. In the South the reproduction of hardwoods by seed is more vigorous than in the North, and generally there is a correspondingly larger proportion of trees of seedling origin in the second-growth stands.

In some sections the forests are made up of stands in which the trees are of nearly the same age. This gives to the forests a regular or uniform character, and is notably the case where the forests have been cut clear or where clearings have been made by fire, as in parts of southern New England, southern New York, and northern New Jersey. Where there is a market for fuel for domestic use the method of clear cutting has been used, and the stands following these clearings are relatively of an even age throughout.

In other instances the custom has been to cut individual trees or small groups of trees here and there as needed to meet the special requirements of the market or a special local use. This method of cutting has resulted in stands which are very irregular in growth, with trees of different ages and of various heights, all mixed together in the same stand.

Usually the second-growth woodlands have been handled without any definite system and without any care as to what the character of the succeeding forest crop may be. In a great many instances repeated fires have been allowed to run through these stands, killing many trees and reducing the density of the woods. Continued abuse of the forests by fire and by wrong methods of cutting have greatly cut down their productiveness. The proportion of good species has

been lessened; there are not as many trees per acre as there should be; in large part the trees are of poor form, with a consequent low-grade product; and the rate of growth is much less than it would be if forestry had been practiced. When the same abusive treatment is applied to a pine or other coniferous forest it is soon destroyed. There are hundreds of acres of pine land in southern New Jersey which have been handled in this way and which are now scarcely better than barren wastes. The wonderful recuperative power of hardwoods and their capacity to send up sprouts after cutting, and in many cases after burning, have maintained a succession of tree crops, though under abuse there is with each succeeding generation a steadily poorer quality and lower intrinsic value. All this may be remedied by protection from fire and by intelligent care in cutting.

In the eastern hardwood forests there are nearly always a number of species in mixture, except in certain soils or situations where practically only one or two species can grow. Most of the hardwoods sprout readily, though there is a great difference in the vigor of sprouting, in the age of best sprouting power, and in behavior in different soils and situations.

In the handling of a given forest stand, or piece of woodland, the peculiar requirements of each one of the component kinds of trees that make up the stand must be considered, and any improvement measures must conform to these requirements. The limits of this article prevent the setting forth of details which will apply to all the various conditions that obtain in the hardwood regions of the country, yet certain broad principles of handling second-growth hardwoods may be considered, subject to modification in accordance with the needs of local conditions.

SIMPLE COPPICE OR SPROUT SYSTEM.

When there is a market for all forest products—fuel, as well as lumber, ties, poles, and posts—the simplest method of forestry in second-growth hardwood stands is to cut clear and to secure the new growth by sprouts from the stump. This is called the simple coppice or sprout system. For many years it has been used in a rough, haphazard way by the farmers of the hardwood region of the Northeast. Conspicuous illustrations of its use are found in southern New England, in southern New York, and in northern New Jersey. Formerly many iron mines were operated in this region, and consequently there was a demand for charcoal. The hardwood forests were cleared off, and the stands which took their place were again cleared off as soon as large enough for use, reproduction taking place by sprouts. As the population increased, demand for fuel succeeded that for charcoal, after the mines were closed, so that in many sections it is still the

custom to clear off the wood at intervals of from twenty-five to forty years.

Sprout reproduction is a very easy system to practice, for there is no skill to be exercised in selecting trees for cutting, and reproduction takes place promptly and abundantly by natural means and without expense. There are, however, certain principles governing sprout reproduction which must be observed in the continued practice of the system. If these are ignored the forests will deteriorate and their productiveness will steadily diminish. Exactly this has happened in New England. No attention has been paid to the condition of the forest after it was cut, to the season of cutting, or to the manner of trimming the stumps. Fires have run through the woods repeatedly, have injured the trees, and have reduced their vitality and sprouting vigor. The result has been that many stumps fail to sprout, the restocking by good species is reduced, and the growth and final yield are greatly diminished.

THE PROPER AGE FOR CUTTING.

Every tree has an age when it sprouts most vigorously, though this period varies with different species and under different soil conditions. But always it occurs in early life and ordinarily under 25 years. There is also a maximum age limit of sprouting; that is, an age after which the power to reproduce by sprouts is lost. In individual cases this may be at more than one hundred years, and it is later with trees that have grown from the seed than from trees that have originated from sprouts. There is a point in the life of a stand of sprouts when certain individuals become defective and weakened and reach the limit of their power to send up vigorous shoots. If a stand is cut after this point is reached—usually from 25 to 40 years of age—some stumps fail to sprout, and reproduction by this means is incomplete. Therefore in the management of a forest under the simple sprout system it must be cut young enough to insure sprouting from practically all stumps, and the cutting should take place as near the age of greatest sprouting vigor as practicable. In Europe oak coppice is often cut at an age of from 10 to 15 years. Experiments have shown that oak at this age sprouts most vigorously and consistently, and that the sprout system of regular cropping can be maintained more successfully and with less work of replacement and fewer failures than when there is a longer interval. In some cases the trees are allowed to grow to be 25 or 30 years old, but generally where larger timber is required the system is modified so that it becomes in effect another method.

In this country, however, the market for small stuff is seldom good enough to warrant the cutting of trees less than 25 years old, though in some places there is a market for small material at brickyards and

limekilns and for domestic fuel. More often it does not pay to cut the stand until at least ties and poles can be obtained from the largest trees. This means a cutting age of 40 years or more. At this age, however, results from the simple coppice method are uncertain, since reproduction from many of the stumps is likely to fail.

WHEN AND HOW TO CUT.

Every important consideration demands that the trees should be cut during the season of vegetative rest, or "when the sap is down." In general, in the climate of New England any time from September 15 to April 1 is favorable. Cutting in April results in good reproduction, but at this time there is danger of injury to the stumps by peeling of the bark and by bruising in removing the wood.

The best sprout reproduction is obtained by cutting low, smooth stumps. Where the time between tree crops is very short, as in Europe, the manner of surfacing the stump is even of greater importance than it is under the conditions in this country. The European forester takes care that a smooth cut is made on a slant, to shed the water, since a ragged or cup-shaped surface tends to hold water and hasten decay. The stumps are so small that they are rapidly covered over by the new growth, and if they are cut properly they are covered before decay sets in. With larger trees, such as are cut in this country, often it is not possible for the new growth to cover the whole stump; but low stumps mean vigorous sprouting, little hindrance to individual development of the sprouts, and much less danger from decay than is apt to occur after careless cutting.

It is important to remove the wood from the clearing as soon as possible. Where the wood is piled and left in place for a season, there are inevitably a good many stumps which are covered by the stacks, and thereby prevented from sprouting. Moreover, when the wood is taken, it is usually done by driving through with a team and heavy wagon, by which large numbers of 1-year sprouts are broken off and otherwise damaged.

One of the serious problems in this country is the disposal of the brush. Ordinarily, the farmer throws the brush in windrows about 30 feet apart. They actually cover about 25 per cent of the whole area cut over. These piles cover a large number of stumps and either prevent them from sprouting or cripple the sprouts enough to make them useless. (Pl. I, fig. 2.) The best way to dispose of the brush is to burn it in small piles, or else to cut up the tops thoroughly and scatter them over the ground.

KEEPING THE TREE GROWTH DENSE.

If the stand is in a healthy condition when it is cut, the stumps sprout vigorously and a fully stocked stand is the result. It often happens, however, that certain stumps fail to sprout, or through pre-

FIG. 1.—A STAND OF SPROUTS 20 YEARS OLD.

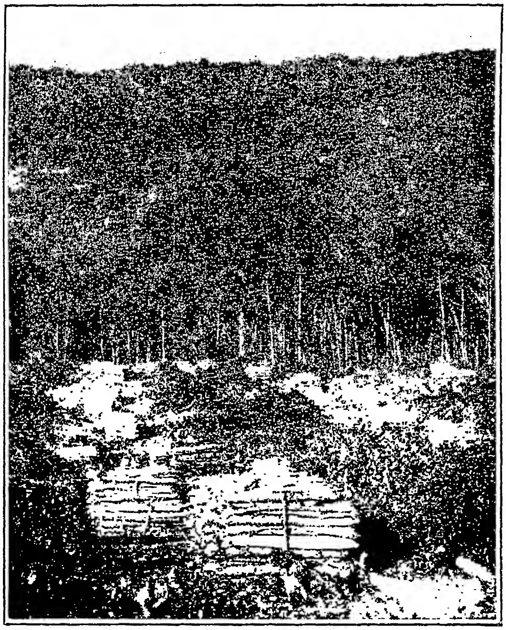

FIG. 2.—A CLEAR CUTTING IN A SPROUT FOREST.

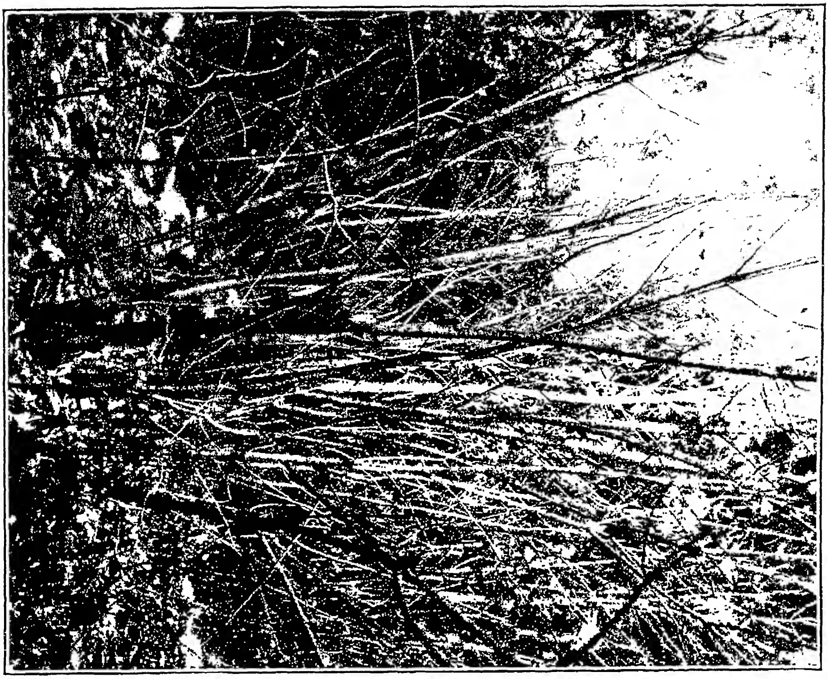

FIG. 1.—A GROUP OF YOUNG SPROUTS BEFORE THINNING.

FIG. 2.—THE SAME GROUP OF YOUNG SPROUTS AFTER THINNING.

vious abuse the stumps are too far apart. Sometimes new stock creeps in by natural seeding. But under the simple coppice method the stand is cut when the trees are young—not old enough to bear much seed. Therefore, any seeding that comes in is largely from neighboring lots containing old seed-bearing trees.

In Europe, where the time between crops is very short, natural seeding is never relied on to fill gaps in the new growth and the openings are always filled in by artificial planting. There, when a sprout stand is cleared, it is closely examined with reference to the condition and vigor of the trees. Spots where there are no stumps and where stumps are likely to fail are marked to be filled. In oak coppice, for example, it is customary to plant in spaces as small as 15 feet square, using oak transplants which have stood two years in the nursery. Ordinarily these are cut back when planted; that is, the seedling is planted and then cut off at the ground. It throws up a vigorous sprout and grows up with the remainder of the stand. Such a plan naturally presupposes a regular organization, with a nursery, and with men in charge of the property who are trained in forest work.

In this country owners of sprout forests cut a lot here and there as the trees come to marketable size. In Europe, a definite system of locating the annual cuttings is extensively used in the management of communal and government forests, because under this system the forests can be so organized that an approximately equal yield is secured each year. This is accomplished by dividing the forest into as many lots as there are years allotted to growth between cuttings, so that, if the trees are to grow twenty years, there will then be twenty divisions, one of which is cut each year. After the work has been in operation through one series of annual cuttings there are 20 ages represented, and one lot is coming to the cutting age each year. If soil and situation are uniformly favorable over the whole forest, these lots are made about equal in size. If there are different types of land, with different qualities of soil and hence with different yield capacities, the lots are made somewhat larger on the poor soil than on the good soil, so that the actual yield in material will be about the same each year.

HOLDING OVER RESERVE TREES.

A modification of the simple coppice method is to clear cut, except for a certain number of selected individuals left scattered over the area to remain during a second rotation or growing period between the regular cuttings. Take, for example, a stand of oak, chestnut, hickory, and maple sprouts 25 years old. Certain straight, thrifty trees are marked to be left and the remainder are cut clear, as in the simple sprout method. At the end of the next growing period,

the main stand will be composed of 25-year-old sprouts, while the scattered individuals reserved from the first cutting are 50 years old. The purpose of this system is to use the land chiefly for the production of small wood and at the same time to obtain a certain amount of large timber. While periods between cuttings are short and returns are frequent, there is secured a measure of the higher and more valuable grades of timber.

To insure leaving the right trees, the man in charge, when the stand is ready to cut, goes through and marks the trees to be reserved. He aims to leave, regularly distributed over the area, as many trees as possible without interfering with the reproduction from the stumps of those cut. As sprouts do not thrive under the shade of other trees, there must be no semblance of a leaf canopy made by the reserves, but the individuals must be scattered. The number left depends on the shade-enduring qualities of the sprouts, which necessarily varies with different species and under different conditions. Further, the number of reserve trees varies with the age at which the sprouts are cut. If twenty-five years is the cutting cycle, more reserves can be left than with a forty-year rotation, because trees at the lesser age have a much smaller spread of crown. As a general rule, the number of reserves varies from twenty to forty to the acre.

The trees chosen for reserves are well-formed, dominant trees, with a moderate crown development. They must be sound, thrifty, and wind-firm. Trees standing singly are better than those growing in clumps, though it is often necessary to leave some of the latter class.

Under this system the money returns are greater than under the simple sprout system, though the total amount of wood produced would not differ materially in cubic volume. The volume of sprout growth would be somewhat less because of the space occupied by the reserve trees and because of the retarding of the growth of the shoots that are affected by the shade of the older trees. It is probable, however, that the loss of growth of the sprouts would be fully counterbalanced by the yield of the reserves in cubic volume, and more than equaled in value. The reserve trees are isolated, and therefore receive full light and put on a maximum diameter growth. They produce in 50 years what it would take sixty or more years to secure in a closed stand. The increased returns would be not less than $25 per acre.

SPROUTS AND STANDARDS.

The principles of the system of sprouts and reserve trees may be carried still further to include the reservation of scattered trees to grow to an advanced age or practically to maturity—or standard size—for the production of high-class material. In this case the

age of the reserved standards will be several times that of the cutting age of the sprouts or coppice.

This is a system long in vogue in Europe and now practiced there very extensively, especially on private and communal forests. As yet the method has not been used systematically in this country, but it will undoubtedly be used as soon as there is a ready market for the small-sized product of sprout growth cut after a short growing period. The description here given necessarily applies to the practice in Europe.

This system is most readily understood by following its development from the simple coppice. Suppose that there is a simple coppice managed on the basis of a 20-year growth, and it is decided to hold over reserves which will be allowed to reach an age of 100 years. When the sprouts are cut a certain number of reserves are selected from among the best trees in the stand. Seedling trees are used if they occur; otherwise the best sprouts are used. If there are likely to be no seedlings in the young growth some are established by planting. Twenty years later, at the time the coppice is again cut, new reserves are selected among the best trees, preferably seedling trees of the 20-year-old wood. After cutting there will then be reserves 20 and 40 years old. After the following 20 years the oldest reserves are 60 years, the next 40 years old; and then some 20-year-old reserves are chosen as before. This process is continued until the first reserves reach the final age designed for them; in this case, there will then be on the ground reserves of 100, 80, 60, and 40 years old, in addition to the 20-year stand composed of sprouts and such seedlings as were established at the last cutting. The oldest reserves are then cut and seedlings established in their places.

There is no rule regarding the number of reserves. Sometimes, in European practice, the main stress is laid on the coppice production and only a few reserves are held over at each cutting. In this case the production of sprouts would be but little interfered with. In other cases the main stress is on the overwood, or older reserve trees. The system then approaches the selection system, by which certain trees are set apart for the production of special material, combined with the production of a coppice crop.

The number of reserves will progressively become less with increase in their age. Theoretically, it is designed to have all classes of reserves occupy equal areas, and enough reserves are held over in the beginning to allow for loss through accident and for thinnings. For instance, when a cutting of the old reserves is made the spaces they formerly occupied are filled with seedlings by planting. The younger reserves are inspected carefully and thinnings are made when desirable, so as to benefit the best reserve trees and to maintain the area occupied by each age class at about the normal.

The species used as reserves are those which have a relatively light foliage, such as oak and ash. The underwood is best composed of comparatively tolerant or shade-enduring species, such as (in Europe) alder, hornbeam, beech, elm, and maple.

The reserves remain in crowded stand only during the life of the sprouts, and consequently have only a comparatively short stem cleared of branches. Since they stand isolated for most of their life, they develop broad-spreading crowns. The diameter growth is at a maximum, and they produce one or two very large logs.

HANDLING OLDER SPROUT STANDS.

In most hardwood forests the simple coppice system with a short growing period is not practicable, because of the lack of market for small material. The period is then extended until the trees, or a portion of them, are large enough for piles, poles, ties, or lumber. The age of cutting in this case is considerably greater than the period of best sprouting capacity. Therefore, reproduction by sprouts alone can not be relied upon, and must be supplemented by establishing many seedlings, either by natural seeding or by planting. The production of the pole class of timber and the reproduction of the stand partly by sprouts and partly by seed demands a special treatment. This is the method by which most of the woodlands in southern New England are treated; there, however, it is practiced without design and with a poor degree of success from the standpoint of forest production. It is customary to cut the forest clear when a profitable sale can be made. The large trees are used for lumber or ties, the straight trees for poles, piles, and posts; the small, defective, and crooked trees, and the tops are used for cordwood.

The trees are cut when from 40 to 80 years old. Some of the stumps sprout vigorously, some throw up weak shoots, and some do not sprout at all. It usually happens that a stand of second-growth hardwoods over 40 years old does not have a complete leaf canopy. This is especially true of stands originating largely from sprouts. The small scattered breaks in the canopy admit light, heat, and a free circulation of air to the soil. As a result, there may be started some advance reproduction from the seed. If this advance reproduction is plentiful at the time of cutting, and there are no fires to destroy it, the reproduction by sprouts will be largely supplemented by seedlings. In this way, many hardwood stands, which are cut at an age when sprout reproduction is uncertain, are followed by surprisingly good second growth. Usually, however, fires run over the ground at frequent intervals, or cattle are allowed to graze through the woods, and at the time of cutting there are very few seedlings or none at all, so that the succeeding stand is composed

chiefly of the shoots from such stumps as may retain their sprouting capacity. There are wide gaps between the clumps of sprouts, and the stand is inferior in form, quality, and yield to the previous one. Continuance of such treatment results in steady deterioration of the forest.

The poor results of this careless and haphazard way of treating second-growth stands are avoided by removing the trees in two or more successive cuttings. The aim of the method is to secure an advance reproduction of seedlings wherever there is a possibility that sprout reproduction will not be complete. This is accomplished by making a thinning sufficient to open the canopy for natural reproduction. When the seedlings have become established the rest of the timber is removed in one or more operations.

The selection of the trees in this method of cutting depends primarily on how far sprout reproduction can be depended upon. If there is uncertainty as to the sprouting of most of the stumps, the effort should be to get a fairly general distribution of seed over the whole area. Thus, in the case of a mixed stand of oak and hickory from 50 to 60 years old, the period of most vigorous sprouting has long since been passed, and it is difficult to tell which trees will and which will not sprout. In making the first thinning the following principles are followed:

(1) The thinning removes about 40 per cent of the volume of the stand.

(2) The cutting takes the suppressed and defective trees and those with large spreading crowns, especially any overgrown individuals which are markedly older than the main crop.

(3) In choosing between two trees, the least vigorous is cut, for the other will bear most seed, will be most likely to sprout after cutting, and will grow most rapidly before the final cutting.

(4) In case of clumps of trees, which have originated from sprouts, only defective and suppressed trees are taken. The dominant thrifty trees in a clump are treated as one tree. If, on account of defect, one or more large dominant trees in a clump must be cut, the entire clump should be removed. If there is not space for a healthy development of sprouts, the opening should be enlarged so as to secure straight and vigorous sprouts.

(5) All scattered individuals of undesired species are removed. Such sprouts as appear will be checked by the shade of the remaining trees.

(6) If there are good groups of advance seedling or sprout reproduction, the trees which are shading them should be cut, and in getting out the wood the groups should be carefully protected.

(7) If for any reason the cutting takes healthy, dominant trees which are likely to sprout, the development of the sprouts is guaran-

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teed by making an adequate opening in the canopy, even cutting the neighboring trees if necessary.

As soon as there is a sufficient amount of seedling reproduction to supplement fully the sprout reproduction, the remainder of the stand is cut clear.

In many hardwood forests of the Northeast there is a mixture of chestnut which sprouts vigorously even when the trees are 60 or 80 years old. Chestnut grows very rapidly and usually has the largest yield of ties, poles, and lumber. The best results are obtained in applying the system above described when the first thinning is confined chiefly to species which are less likely to sprout, like oak and hickory. It often happens that the chestnut occurs more or less in groups of from 5 to 10 clumps together, though individual clumps and trees occur scattered among the other species. The chestnut should be cut no more than is absolutely necessary at the first cutting, on the same principle as in an oak stand—that the individuals most likely to sprout well are left until the final cutting; though it may happen that an owner may wish to cut the chestnut, or a part of it, as the first cutting. In that event whole clumps should be cut and not individuals from a clump, and in all cases openings should be made large enough for good sprout development. The presence of young chestnut sprouts here and there in the stand will necessitate care in taking out the wood at the second cutting, in order not to injure them. The average second-growth stand of hardwoods 50 years old in New England yields about 30 cords per acre. The first cutting removes from 8 to 12 cords.

The final cutting may be made after an interval of from 5 to 10 years. Ordinarily the final cutting is a clearing. This is the best plan, for if there were more than one operation in the final cutting there would be a great deal of damage to the sprouts when the larger trees are felled and removed. In many cases, however, it may be desirable to leave scattered reserves to remain during a second period of growth.

In making the first cutting the cost of cutting and piling the wood is about 10 cents per cord more than if the stand were cleared. The cost of removing the wood is also increased about 10 per cent. The cost of marking is about 5 cents per cord. The total added cost of the method over that of the old method of general clearing, including the burning of the brush, is about 35 or 40 cents per cord for the wood taken in the first cut.

IMPROVEMENT CUTTINGS.

Improvement cuttings are those made in immature stands to improve their character and growth. Their specific objects are: To secure better kinds of trees in the composition of the stand, to im-

prove the form of the trees, to accelerate the growth of the trees, and to increase the yield and value of the final product. Ordinarily, improvement thinnings are not made under the simple coppice system when that is used with the short rotation. When, however, the trees are allowed to reach an age of from 25 to 50 years, it is very advantageous to make one or more improvement thinnings. Such thinnings are practicable where there is a good market for cordwood. Inasmuch as the thinnings remove dead, dying, crowded, and otherwise low-grade material, they are an actual expense unless this material can be disposed of by sale, or for home use. Under present conditions, therefore, improvement thinnings in second-growth sprout forests are confined largely to farm woodlots and to localities near thickly-populated communities. In some cases they are made in young stands.

In nearly every young stand there are considerable numbers of individuals of poor species and poor form which are taller than the surrounding trees; if allowed to stand they interfere with or actually kill those of higher prospective value. If the trees are to stand until old enough to produce poles, ties, and lumber, it is very desirable to cut out these stragglers. The cutting is best made when the stand is young—less than 10 to 15 years old. The stragglers have not had a chance to do any appreciable damage; the openings made in the cutting are quickly closed by the spreading of the crowns, and the work is most easily and cheaply done at that period. These early cuttings are designed merely to remove undesirable individuals.

Thinnings are also made to reduce the density of the stand. The stumps send up sprouts in great numbers, and as these sprouts develop there is not only a competition between groups of sprouts from different stumps, but a fierce struggle between the sprouts in each group. The object of thinnings is to assist nature and to give the advantage in the struggle to the most promising trees. The best trees are given just the right amount of light and growing space to develop a good form and to grow at a maximum rate. The result is that the individual trees grow more rapidly than otherwise. Not only is it possible to bring a stand to merchantable condition 10 years sooner than if it were not thinned, but the aggregate yield is greater than without thinnings, and the quality of the product, and hence its value, is increased.

Usually sprout stands are thinned first when from 25 to 30 years of age. The reason why they are usually not thinned earlier is because most owners do not wish to thin until the wood is large enough to pay for the cutting. Of course, it is often not possible to make a thinning pay expenses at 30 years of age when there is not a good market for cordwood. But it is very desirable to make the thinning by that time if possible. When a man can do his own work, or when one of the regular hands on the place can do it when other work

is slack, sprout stands may be thinned when from 10 to 15 years of age. (Pl. II, figs. 1 and 2.) The advantages of an early thinning in sprout stands are these: The excessive natural crowding is avoided, the trees are allowed to develop straight stems, the energy of the old root systems is concentrated on a few trees, and the trees have sufficient light and space for rapid growth.

In making such an early thinning there are chosen to remain standing from two to five of the best sprouts on the stumps and the rest are cut. The ones selected are the largest, straightest, and soundest individuals. The cutter keeps in mind also the relative position of their crowns. So far as possible he leaves a symmetrical clump whose crowns will not only close together but will also soon meet those of the neighboring clumps and form a complete crown canopy over the ground. As a rule this operation does not yield any useful material.

When an unthinned stand has reached the age of from 25 to 30 years many of the sprouts have been killed in the natural struggle for space. One finds at that time that the strongest trees have taken their place as the leaders, with larger crowns and larger diameters than the others. There are other trees nearly as tall as the leading trees but with shorter and narrower crowns, and they are obviously dropping behind in the struggle; still others are much shorter, with crowns touching the lower parts of those of the leaders; and finally, thoroughly suppressed, dying, and dead trees are scattered throughout the stand.

The aim in thinning is first to take out all the dying and dead material that can be used. The next object is to aid the growth and development of the best trees in the stand. In making a thinning one studies primarily the crowns of the trees. One does not consider the number of trees per acre or the distance between the stems. The idea is to give the sound, thrifty leaders the right amount of crown space for their best development. Therefore one looks to the leaders and thins out those poorly developed trees which are crowding them. The general rule is never to cut a tree of desirable species, no matter how small, which is sound and doing no harm. The thinning removes dead, dying, unsound trees, and those which are crowding and interfering with the development of those of better promise. Sometimes a leading tree may be of poor species, unsound, or of poor form. It may then be better to cut it out and allow some of the surrounding trees of intermediate development to grow up and take its place.

The thinning results in making small breaks in the canopy, which will close together in about five years. Ordinarily about from 18 to 20 per cent of the volume of the stand is cut. The best results are obtained if the thinning is repeated at intervals of from five to eight years, until the stand is ready for reproduction.

THE AGRICULTURAL DUTY OF WATER.

By W J McGee,
Soil Water Expert, Bureau of Soils.

IMPORTANCE OF WATER IN THE SOIL.

The wealth and power of any country spring chiefly from the soil. In nature the soil sustains a flora and the flora sustains a fauna; and the plants and animals of the land depend for their living on the products of reactions going forward in the natural laboratory within the soil. Man derives food and clothing from the plants and animals sustained by soil, and with growth of knowledge and power he modifies the flora and fauna and finally improves the soil at will; and it is in this reconstruction of the face of nature for human welfare that humanity most fully comes into its own.

The experience of the farm in every country and age has shown that the fruitfulness of soil depends on adequate water supply; no water, no crops, no animals, no human life—indeed, no soil. The experience of recent years in this country, especially in the arid regions where water is measured, has shown that there is a direct relation between the quantity of water supplied to the soil and the quantity of crop yielded by the soil; and inquiry into the relations between water supply and yield has thrown light on the properties of soils.

CONSTITUTION OF SOIL.

Soil is of three parts—one solid, another fluid, and the third gaseous. The solid part consists of mineral and organic matter in fragmentary or granular condition; it forms the stable body of the soil. The fluid part is a solution consisting of water carrying mineral and organic matter; it forms the circulatory medium of soil and plants. The gaseous part consists of air (nitrogen and oxygen) mixed with aqueous vapor, carbon dioxide, hydrogen dioxide, etc.; it permeates the body of the soil, moving with the movement of the circulatory fluid, changes in temperature and barometric pressure, etc. The three parts are conveniently known as soil body, soil fluid, and soil gas.

The soil of a country forms a unit or entity hardly less complete and distinct than the flora or the fauna. It differs from these in that

it is suborganic rather than definitely organized, and in that it commonly contains a larger proportion of mineral matter; yet it resembles them in that it has its own modes of action and self-perpetuation, and in that it functions in accordance with its own special properties. Its internal action or functioning goes forward chiefly through the agency of its fluid and gaseous parts. In the absence of its circulatory medium it soon becomes inert or dead, losing its suborganic character; in the presence of soil fluid it is constantly vitalized. Its reactions are largely connected with the growth and decay of the organisms it sustains, so that its functioning is correlative with that of the flora and fauna. Much of the substance of plants is taken directly, and that of animals indirectly, from the soil, and soil grows largely through the return of substances from plants and animals in more highly differentiated or richer form; and the chief source of vital energy in soil (expressed by its own functioning and measured by its fertility) is derived from the growth and decay of plants and animals. Thus, potash and nitrates are elaborated and concentrated by plants and phosphates by animals and returned to the soil, which is thereby enriched and rendered more effective in sustaining both plants and animals. During the ages the organisms and soil have interacted, and in a broad way the organisms have produced the soil which sustains them.

While the interdependence of soil and organisms extends to all the materials and powers of both, it operates chiefly through the peculiarly potent substance H_2O or water, of which large quantities exist in the soil and pass thence into the plants and animals; and the vital energy of organisms, like that of soil, is maintained largely by the circulation of their fluid portions, which consist chiefly of water. In most animal genera the circulation is fairly uniform throughout life; among most kinds of plants it varies widely with the season; while in soil the circulation depends largely on climate and season, especially as these are related to plant growth. Other things equal, the internal work or functioning of soil is determined by its capacity for conserving water and conveying it to growing plants.

THE SOIL FLUID.

The fresh water entering soil is derived from rain (or melting snow) either directly or through overflow or underflow by irrigation or otherwise. The water within the soil may be or may not be efficient in circulation (or in soil functioning) according to its quantity in relation to the soil texture; for with its quantity its condition may be said to vary from (1) static to (2) dynamic; i. e., it may be either inert or active.

The full capacity of a given soil for water ranges with its texture or porosity from some 30 per cent to over 50 per cent of its volume.[1] This may be denoted the water of saturation; it completely fills the interstices among the soil grains, displacing the soil gas, and ordinarily moves hydrostatically under the impulse of gravitation; it impedes or prevents normal functioning of the soil, and remains in a virtually static condition until the excess is removed by drainage or otherwise.

The water required to form soil fluid (or to furnish the optimum soil moisture) ranges with the texture of the soil body from say 10 per cent for sand to 40 per cent for fine clay and much more for muck. The quantity suffices to form a film surrounding each soil grain in such manner as to permit capillarity to act throughout the mass and yet leave space for air (or soil gas) within the interstices. Through surface tension these films tend to flocculate the finer soil particles, and promote physical and chemical action both within the soil grains and between the soil gas and the soil body; apparently the films are the chief means of interchange between inorganic soil matter and growing or decaying organic matter; and though subject to gravitation, the water forming them moves mainly through capillarity under stresses acting dynamically in the normal functioning of the soil. Probably the energy of internal action within the soil fluid increases with the thinning of the films (i. e., with the diminution of the water) from the point of subsaturation at which capillarity begins to the indefinite point at which capillary contact is interrupted and the moisture becomes hygroscopic; so that functioning is most vigorous in a moist but drying soil.

While the aggregate quantity of soil fluid varies widely with different soils of varying texture, the limiting points of subsaturation and interrupted capillarity vary in a measurably corresponding way; so that an approximate estimate may be made of the soil fluid available for plant growth in average soil. The basis of estimate may be the 4 feet of soil and subsoil throughout which capillarity operates freely;[2] for while ordinary annual crop plants root within the first foot from the surface, the underlying 3 feet of subsoil forms a reservoir whence they derive much of the moisture required for their growth. Now, the mean moisture of average soil when in good condition approaches 25 per cent, while the mean moisture

[1] Slichter computed the porosity of aggregations of spheroidal grains to range from 25.95 per cent to 47.64 per cent of the aggregate volume: The Motions of Underground Waters, Water Supply and Irrigation Papers of U. S. Geological Survey, No. 67, 1902, p. 20. King computed the porosity of soils to range from 34.91 per cent in coarse sand to 52.94 per cent in finest clay: Physics of Agriculture, 4th ed. 1907, p. 124.

[2] King found that capillary lifting of water through fine sand diminished from 2.37 pounds per day at 1 foot to 0.91 pound at 4 feet, the diminution being less with clay loam: Principles and Conditions of the Movements of Ground Water, Nineteenth Ann. Rept. U. S. Geological Survey, 1899, Part II, p. 85.

when plant growth ceases by reason of exhaustion of the soil fluid is probably less than 10 per cent;[1] and the difference measures the store of water additional to the current rainfall, on which the plants may draw. This difference (15 per cent of 4 feet, or 7.2 acre-inches= 816 tons per acre) may be denoted the effective soil fluid of average soil.

SOIL-PLANT CIRCULATION.

While the soil fluid moves (descending with rain, ascending with surface evaporation, and shifting with changes in temperature and barometric pressure) largely by capillarity, the leading force controlling its movement is that of growing plants; the soil fluid supplied by rains or irrigation or taken from the subsoil store lodges in the soil-grain films until it is drawn into the plant through root hairs or other structures, forced through the tissues by osmotic stress and surface tension, and finally evaporated through stomata or other structures. On returning to the air it lowers somewhat the local atmospheric vapor tension, and so balances the conditions on which circulation depends.

The rate of soil-plant circulation and the quantity of water passing through soil and plants during the growing season are indicated by the exhalation from growing plants. A grass plant will in the course of a hot day exhale its own weight of water, and a young leaf of wheat or rye exposed to the sun may even exhale its own weight in an hour. Experiments summarized by Storer indicate that "more than 300 pounds of water pass through a plant, and are transpired from its leaves for every pound of dry matter fixed or assimilated by the plant."[2] In Wisconsin King found the mean amount of water used by barley, oats, corn, clover, peas, and potatoes in producing a ton of dry matter ranged from 270 tons for corn to 576 tons for clover, "the average for the six crops being nearly 450 tons or 4 acre-inches per ton of dry matter."[3] In Idaho Alex McPherson, director of experiment stations, undertook in 1906 to measure the water used on an experimental farm, and obtained the following ratios of water to crop: Alfalfa, 432.78 to 1; beans, 152.9 to 1; beets, 90.7 to 1; carrots, 77.18 to 1; corn, of four varieties, 92. 9, 133.8, 139.5, and 176.8, or an average of 135.75 to 1; oats, 90.86 to 1; potatoes, 46.28 to 1; and wheat, 66 to 1.[4] The measurements were made only during May, June, July, and August, without allowance for accumulated ground water or natural subirrigation, and on the assumption "that the amount of water evaporated from a water-free surface, as shown

[1] The mean of King's determinations of soil moisture "when growth is brought to a standstill" (Physics of Agriculture, op. cit., p. 125) was 10.93 per cent for clover and 8.92 per cent for maize.

[2] Agriculture in Some of its Relations with Chemistry, 7th ed., 1897, vol. 1, p. 15.

[3] Op. cit., p. 140.

[4] Third Annual Report, dated Twin Falls, Idaho, Apr. 4, 1908.

by the evaporating tanks, was equal to the evaporation from the soil, the seepage, and the amount actually used by the plants"—an assumption undoubtedly rendering the figures too low. The quantity of water used varies with the yield; e. g., in McPherson's test the yield of alfalfa was 7 tons per acre, equivalent to 3,030 tons, or 2.23 acre-feet of water.[1]

The maintenance of the soil-plant circulation required for crop production generally involves repeated additions of water during the growing season; for the effective soil fluid within 4 feet of the surface would at the observed rate of plant transpiration suffice for but a meager yield even if the entire quantity were utilized. In ordinary farming the water is not fully conserved and applied to plant growth, so that practically the 7.2 acre-inches of effective soil fluid would not suffice to produce a crop, or even permit any yield whatever from most types of soil; though under certain conditions water may be drawn from greater depths in the subsoil than 4 feet. If properly cultivated and watered, the average acre-foot of soil, weighing some 2,000 tons (including the contained water), retains efficiency for centuries; but to be even moderately productive this soil must convey to the crop plants fully 1.5 acre-feet of water, or an amount equivalent to its own weight, during each growing season.

To become effective in plant growth, water must enter the soil body, take up both mineral salts and organic substances in solution, and pass thence into the plants and on into the air; this is the normal course of soil-plant circulation; and the relative quantities of the solid and fluid parts of the soil involved in plant growth probably correspond fairly with the strength of the solution, or one to several hundred. Pending precise determinations it may be assumed that the strength of the solution forming the soil fluid, and the ratio of the solid and fluid parts required to maintain efficiency, are about equal and something like 1 to 1,000.

RATIO OF CROP TO WATER SUPPLY.

In nature the flora varies with the rainfall from sparsely distributed cacti and other desert plants to luxuriant forests; and as lands are brought under cultivation the crop yields vary from place to place and from season to season with the rainfall or with the water supplied by irrigation. Generally throughout the United States the actual yield per unit of water is considerably less than the ratio of dry matter to water determined by plant exhalation. A fair to good

[1] Convenient equivalents involved in the use of customary units for the measurement of water are:

1 gallon=230.972 cubic inches=0.1336 cubic foot=8.34 pounds.
1 pound=27.68 cubic inches=0.12 gallon.
1 ton=2,000 pounds=32.04 cubic feet=239.68 gallons.
1 cubic foot=62.42 pounds=7.485 gallons.
1 acre-foot=43,560 cubic feet=1,359.6 tons=326,047 gallons.

crop from an acre (i. e., an acre-foot) of fertile soil supplied with 4 acre-feet of water during the year may be put at a ton of grain and 3 tons of stover and stubble, or 4 tons in all—equivalent to $\frac{1}{1360}$ of the weight of the water. With lessening of the aggregate water supply (which of course includes rainfall, accumulated ground water, subsurface flow, and irrigation), the yield diminishes more rapidly than the quantity of water, virtually ceasing when the supply falls below an acre-foot, while with augmented supply the yield increases more rapidly than the water so long as the tillage and character of crop are adapted to full use of the entire supply.

Illustrative estimates of yields of grain with varying water supply.

Water.	Equivalent in tons.	Corn.		Oats.		Wheat.		Aggregate.	Mean.
		Bushels.	Equivalent in pounds.	Bushels.	Equivalent in pounds.	Bushels.	Equivalent in pounds.	Pounds.	Pounds.
$1\frac{1}{2}$ acre-feet	2,040	10	560	15	480	6	360	1,400	467
3 acre-feet	4,080	35	1,960	40	1,280	12	720	3,960	1,320
4 acre-feet	5,440	70	3,920	80	2,560	25	1,500	7,980	2,660
5 acre-feet	6,800	105	5,880	120	3,840	40	2,400	12,120	4,040
Sums	18,360	....	12,320	....	8,160	....	4,980	25,460	8,487
Averages	[a] 4,590	....	3,080	....	2,040	....	1,245	6,365	2,122
Ratios	....	1 : 2,980		1 : 4,500		1 : 7,374		....	1 : 4,326

[a] 9,180,000 pounds.

Illustrative estimates of the yield of certain crops with varying quantities of water, based on personal observations in all sections of the country during a quarter century, are shown in the accompanying table; the mean ratio of the grain is $\frac{1}{4326}$ of the water; if the stalk, straw, husk, stubble, and roots are thrice the weight of the grain, the total yield is to the water as 1 to 1,082.5. The yield of pasturage, forage, fruits, tubers, timber, etc., is of course much greater than that of grain; the average of all crops in good farming may be put at 6 tons per acre year; i. e., $\frac{1}{333}$ of the weight of the first foot of soil (solid and liquid), or approximately $\frac{1}{1000}$ of the weight of the water circulating in the soil body throughout the year and largely conveyed to the growing plants.

This ratio of crop to water is smaller than those worked out in Germany by Hellriegel ($\frac{1}{453}$) and in this country by King ($\frac{1}{450}$); for it rests rather on general practice than on special experiment, and its basis is the aggregate yearly supply of water from all sources, including that required to maintain proper soil-texture, of which a part is lost by surface evaporation throughout the year, rather than the water exhaled during the growing season.

With present knowledge the ratio is, of course, but a rough approximation. Measurements are vague and experiences variable; soils differ both in composition and in the texture controlling circulation, and the yield of succulent vegetables or of juicy fruits or fresh forage may be several times that of grain, nuts, or dry forage, so that it will probably be found needful in time to work out ratios for particular crops, just as it is now convenient to reckon yields per acre in different averages for the several crops. Still, if scientific methods are to extend to the farm, no inexactness in the ratio or variability with different crops can remove the need for recognizing some definite relation between the water passing from soil to plants and the crop produced through this circulation.

DUTY OF WATER.

In the course of his work on irrigation, Powell recognized the necessity for determining "the amount of water which is needed to serve an acre of land," and spoke of this service as the "duty" of water measurable in acre-feet,[1] and irrigators have frequently applied the phrase to the measure of the water rather than of the service performed by the water;[2] a service susceptible of useful measurement only in terms of what the water does in that production which furnishes food for man and forms the foundation for human industries and institutions. So, pending more precise determinations, the agricultural duty of water may be defined as the production of one one-thousandth part of its weight in average plant crop, or one four-thousandth of its weight in grain.

Naturally, the coefficient for plant yield will not apply to general farm production, including crops of meat, eggs, wool, hides, etc.; for not only do animals drink many times their weight in water annually, but they consume indirectly in their feed the equivalent of that much larger quantity required for the growth of the vegetal tissue of which the feed consists. The human consumption is still larger. In illustrative estimate, a pound of bread is the equivalent of 2 tons of water used by the growing grain, and a pound of beef the equivalent of 15 to 30 tons of water consumed by the ox, both directly and indirectly through feed; and the adult who eats 200 pounds each of bread and meat in the course of a year consumes something like a ton of water in drink, and the equivalent of 400 tons in bread and

[1] "The irrigable lands of the arid region," The Century Magazine, vol. 39, 1890, pp. 770–771.

[2] Professor Fortier, in judiciously discouraging excessive use of water in irrigation, says: "We find that the average duty of water over two-thirds of a million acres of land was recently shown to be 4⅔ feet per acre. Assuming an average rainfall of 15 inches, this would represent a total of 6 feet of water in depth over the surface." (Proceedings Seventeenth National Irrigation Congress, Spokane, 1909, p. 274.)

4,000 tons in meat, or 4,401 tons in all, besides the use in ablution of from 100 pounds to 200 tons (12 to 48,000 gallons, or from a gill to some 4 barrels daily) according to habit of living. These figures correspond fairly with current experience of intensive agriculture in the arid region, in which water is measured more carefully than in humid lands; here a 5-acre farm supplied with, say, 5 feet of water suffices for a family of five, i. e., an inhabitant per acre or 640 per square mile (cities balancing more barren tracts), and on this basis the 5,000,000,000 acre-feet (or 215,000,000,000,000 cubic feet) constituting the total yearly water supply of mainland United States would suffice for a population of about 1,000,000,000, which at the current rate of increase will be reached in some three centuries, i. e., a future span equal to that passed since the Pilgrims landed on Plymouth Rock. So in a broad way it may be said that the final duty of water is to sustain a human life a year for each 5 acre-feet used effectively in agriculture.

COMMUNITY WORK IN THE RURAL HIGH SCHOOL.

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EVOLUTION OF THE RURAL HIGH SCHOOL.

A few years ago the rural high school was merely a city high school set down in the country. It taught only the traditional subjects and found its chief function in preparing a few studiously inclined pupils for college. It afforded no vocational instruction or training, and its teachers were able to perform their entire duty, satisfactorily, too, without exerting any particular influence upon, or even coming into contact with, those members of the community who were not enrolled in its regular classes. The school was in session five or six hours a day for five days a week during thirty or forty weeks of the year; throughout the remaining hours, days, and weeks it was closed and apparently forgotten.

Such schools prevail to-day, but they are no longer satisfactory; a new type of school is evolving and a new conception of the functions of the rural high school is growing. In the cities the establishment of technical high schools or units, affording vocational education in business methods and practices, in home economics, and in the various industries, met with such immediate and hearty approval that the class rooms, laboratories, and shops of these schools soon became crowded, while many vacant seats confronted the teachers in the classical and college-preparatory schools. In the country a like hearty approval has been given vocational courses in agriculture and home economics wherever these subjects have been introduced, and the experiment has gone far enough to demonstrate its practicability and to give unmistakable evidence of its popularity in terms of increased attendance and special state appropriations for instruction in agriculture and home economics. Another indication of the popularity of such work is found in the tendency to speak of schools in which these subjects are definitely provided for as "agricultural high schools," and, indeed, the term is not inappropriate in the case of schools doing real high-school work and employing special teachers for these vocational subjects. It is with such schools that this paper will deal.

A NEW POINT OF VIEW—COMMUNITY TEACHING.

But the evolution of the rural high school into an agricultural high school has been accompanied by a more important change than the addition of subjects and a change in name. In many cases it has resulted in an entire change in the point of view. Educators are beginning to see that the agricultural high school, in addition to its duties to the pupils who enroll in its classes, may ultimately find one of its greatest fields of useful endeavor among those members of the community who do not attend school and for whom the school funds are not usually appropriated. It is by its work with the community at large—with the men and women on the farms and the boys and girls who can not attend school regularly—that the agricultural high school may find its strongest claim upon popular attention and its greatest field for vital service.

This new work of the agricultural high school bears a strong resemblance to the work carried on by many of the agricultural colleges under the head of "extension work," or "extension teaching." Its name in the agricultural college illustrates well the newness of its place in education, which is still more strongly emphasized by the fact that in the agricultural high school the work has as yet no name at all. Perhaps the designation "community work" expresses it well. This work in the high school differs from that in the college, however, in that the high school deals with folks at first hand while the college often treats with them at the length of a State. The agricultural high school usually is situated in the midst of a farming people. It is with them that its work lies. The community work of the agricultural high school is thus elemental, since there is no loss of power in transmission where the people and the pedagogue meet. Its work is around about it; the results will be at its doorstep.

This effort of the agricultural high school to uplift its rural community is aided by the fact that it is a vocational school. Even though schools of the old or classical type might just as much desire to help the people, yet they would find less opportunity and ability to do so because of their limited equipment along lines of practical things. The old type of high school would find it difficult to extend among all the people its teaching of history, mathematics, or languages. The agricultural high school, however, finds it easy to extend its teaching of agriculture, domestic science, or manual training; for the world needs few scholars but many breadwinners; and though few persons are interested in Greek, all farmers and a very large percentage of other people are interested in agriculture.

This community work is so new and the point of view so foreign to the old-school idea that it is little wonder that the vision of an institution for all the people all the time is slow of realization. The

members of high-school boards are seldom men who are conversant with the problems of rural education or of agricultural needs. That they are not sufficiently conversant with the new ideal to urge it upon the school principal is not strange. The head of an agricultural high school—be he called principal, director, or president—is supposed from his education, position, and predilection to be a man in keen sympathy with rural needs and welfare. It remains for him to conduct as much of the broader work as his equipment will permit and the authorities allow, and upon him must fall the responsibility for developing community work. He must not look at first for either encouragement, assistance, or extra pay from the board of control, but rather to his own sense of duty toward the country and his school, while hoping for the ultimate uplifting of his community as a reward which may or may not be accompanied by the open approval of the board. This does not mean that the teacher is justified in antagonizing the school board by beginning a work of which they do not approve. Experience has shown that tactful beginnings will seldom meet open opposition from the school authorities, provided the new work does not mean an immediate expenditure of funds. As the work proves its great value and usefulness, a request may be made for such funds as are necessary to broaden it. These will usually be forthcoming, for there are few school boards that will withhold support from good community work, once its value is demonstrated.

THE DIFFICULTIES MORE APPARENT THAN REAL.

The difficulties of this work are not such as to be a valid reason against its undertaking. At first it might seem that two substantial grounds appear against it—first, that it is unfair to add a new and larger enterprise to the already overburdened shoulders of the high-school teacher; and, second, that to successfully operate a series of community enterprises requires a special preparation and ability.

The community work of the agricultural high school actually furnishes a large means of assistance to the principal and the teachers engaged in it. While requiring time and energy to carry it on, the work lessens the troubles incident to gaining interest and cooperation throughout the neighborhood. It is assumed that every principal of a successful agricultural high school devotes the great majority of his out-of-school hours to work of some kind for the school; but it is often true that these hours are spent in futile and petty attempts to gain public interest, because the principal fails to appreciate the fact that the people want things directly aimed at their betterment. In every community there are many farmers in dire need of help in the modern methods of farming and farmers' wives in pitiful want of the teachings of household economy. Is it strange that, when the

outward manifestations of the school are largely fairs, bazaars, and festivals, the people refuse to consider it seriously or to support it loyally? When, however, the school begins actual work with the people for their education, frankly and openly avowed, the principal will note an immediate change in their mental and financial attitude. The community work then becomes his strongest support, the frivolous exercises can be curtailed or abolished because unnecessary, and the principal will find his work made enormously lighter and more interesting because of the help from the people.

This help has been very definite and concrete in the case of a number of schools located in the vicinity of exceptionally intelligent farmers and good farms. There are many instances of such farmers coming to the schools and lecturing to the pupils—telling them how they have succeeded in developing a particularly good strain of cotton or corn, how they have grown "bumper" crops of tomatoes, or what systems of rotation they have followed. In other instances they have brought their best horses or cattle to the schools, or they have permitted the high-school pupils to visit their farms to inspect buildings and live stock, and in either case they have given advice and suggestions freely. This is a type of agricultural instruction that is particularly attractive and valuable to the pupils, because it is so clearly based on successful practice. Furthermore, it supplements in a very economical way the limited equipment of the small agricultural school and is of great assistance to the teacher of agriculture.

The second apparent difficulty is based upon the supposed lack of preparation or ability on the part of the principal to carry on such work. Actually, however, community work is much less difficult and more inspiring than the class-room work with the children. The grown folks come to their meetings for knowledge or from curiosity, or both. The children often come because they are sent. The people, in any case, are definitely and directly interested, while the children seldom are. Unless the principal has sufficient knowledge to work with the farmers he has no authority to teach their children agriculture. The only agricultural teaching worth while is that which can stand the test of practice. As a matter of experience, the principal will usually be surprised at the simplicity of the lessons, demonstrations, experiments, or field trips which will please and interest the farmers. To one conversant with local conditions it is easy to plan meetings of far more interest than an institute planned by an outsider not thus informed. A successful teacher of children can without difficulty become a successful instructor of their parents, since the requirements in both cases are the same, viz, a true desire to help folks, a keen sympathy with others, a clear method of conveying thought, a real knowledge of modern agriculture. These can readily be acquired by any real teacher.

SOME FORMS OF COMMUNITY WORK.

Some of the forms of community work now practiced in agricultural high schools are (1) work with farmers, as winter lecture courses on agriculture, corn and potato shows, field and orchard demonstrations, home experiments, good seed distribution, seed and milk testing, preparing plans for buildings, and selecting and purchasing improved live stock and farm machinery; (2) work with farm women, as afternoon or evening meetings and short courses at the school, house-to-house meetings, and home garden and poultry experiments; (3) work with young people, as short courses in agriculture and home economics, literary societies, and nature-study clubs; (4) work with rural school teachers, as meetings for agricultural instruction, nature-study rambles, attendance at school fairs and rallies, and outline lessons in agriculture and home economics published in local educational journals; and (5) work with rural school children, as boys' agricultural clubs, girls' domestic-science clubs, summer vacation encampments, rural improvement field days, and athletic field days (Pl. III, fig. 1).

All of these forms of community work have been carried on in various parts of the country by agricultural high schools or rural high schools with agricultural departments. Farmers' institutes and short winter courses for farmers and for their sons and daughters have been successfully conducted in connection with such schools in Maryland (Pl. III, fig. 2), Minnesota, Wisconsin, Virginia (Pl. IV, fig. 1), and elsewhere, usually with the aid of lecturers and demonstrators from the state agricultural colleges and experiment stations; numerous "corn shows" and "corn congresses" have been held; field demonstrations with growing crops are of quite general occurrence, and orchard spraying demonstrations have been conducted in a number of places, notably in Maryland (Pl. IV, fig. 2), Pennsylvania, and Virginia; several schools have made purity and viability tests of seeds and butter-fat tests of milk and cream for their patrons, and at least one school in Minnesota has grown purebred seed corn and sold it to the neighboring farmers (Pl. V, fig. 1); and plans for buildings and advice concerning the purchase of live stock and farm implements and machinery have in a number of instances been furnished by teachers of agriculture in these secondary schools. Not much of the work here suggested for farm women and rural school teachers has thus far been attempted, but beginnings have been made, as will appear a little farther on in this article. Short courses for young people (Pl. V. fig. 2), nature-study clubs, boys' agricultural clubs, girls' domestic-science clubs, and summer vacation encampments have all been tried and their worth has been fully demonstrated.

The rural improvement field day has thus far been confined mainly to tree planting on Arbor Day, but might well be extended to other forms of rural improvement, such as ridding the neighborhood of flies and mosquitoes. What more commendable enterprise for a rural school than a "mosquito day?" With all of the pupils and their parents cooperating on a given day in spring, it would be a comparatively simple and easy matter to visit every stagnant water pool and either drain it permanently or destroy all the "wrigglers" in it with a little application of kerosene. There is abundant free literature telling how to rid the country of mosquitoes, flies, and other pests; all that is needed is intelligent leadership and effective cooperation.

Every agricultural high school will find it a great advantage to carry on at least one form of community work with each of the five classes of people mentioned above. None but the very largest schools will find it advisable to undertake all of the different forms for each class—the time of the instructing staff would not permit; but even the smallest schools should reach every class of persons and do some things which will be of direct benefit to every person in the neighborhood. A school for all the people is the dominating thought in this community work. As such, every class should be participants in its activities. The best work for each class can only be determined by a careful consideration of the community in which the school is situated. The school principal and his teachers must decide first what the community most needs and desires, and, second, what it is possible to do with the facilities at their disposal. Their judgment may not always be correct, but a revision of policy is always possible. No class of people should be neglected merely because it proves difficult to interest. On the contrary such is almost always an indication that there the work is most needed; the most narrow and bigoted persons are always the most ignorant, and those who have fewest interests are hardest to interest. It will be found that the persons who respond easiest and quickest to community work are those who are the most successful on their farms, most competent in their homes, most skillful in their business, or most thorough in their studies.

COMMUNITY WORK OF THE AGRICULTURAL HIGH SCHOOL OF BALTIMORE COUNTY, MARYLAND.

The methods to be employed in any given school must be judged by local conditions. A typical procedure is that of the Agricultural High School of Baltimore County, Md. This school has been in operation only one school year, but it has already carried on at least one type of work with each class of people in its neighborhood. As a result, the people are frankly and heartily interested in the school and already regard it as one of their best possessions.

The school is a small high school maintained by county school funds. It is thus an integral part of the school system of the county. It is located out in the open country, not adjacent to any town or village, but near a station of the railroad over which many of the high-school students travel to and from school daily. Four elementary schools totaling 90 pupils were consolidated in two classes which meet in the high-school building. The high-school department had in the first year 50 students. School wagons and private conveyances bring many whose homes are not adjacent to the railroad. The school has 7 acres of ground and a good granite building which contains 5 class rooms, the two largest of which can be converted into a hall for meetings. It will seat 300. There are 3 laboratories and a farm-machinery room in the basement. The school has its own heating, lighting, and water-supply systems. It teaches all the usual high-school subjects, except foreign languages, and, in addition, agriculture, home economics, and manual training.

When the school started it was decided as a definite part of its policy that, for the fulfillment of its possibilities, educational facilities must be offered for every class of persons in the community—men, women, and children. Before the school opened a mailing list of persons in the county was made. The principal was new to the community; he knew no one. This list was to be his method of reaching all the folks. The list was compiled from subscription lists of county papers, poll lists of voters, memberships of farmers' clubs and granges, account books of physicians and lawyers, and other sources. When the list was made up into a cross-reference card index, a very valuable fund of information was obtainable about almost any one in the county. It was not only possible thus to have a list of all persons living on farms or interested in agriculture, but also to tell at a glance whether they were persons of prominence or not, and even what their politics were supposed to be. From time to time supplementary information is added to these cards, such as whether a letter of inquiry sent out by the school was answered, whether certain activities of the school were attended, and so forth. Ultimately this list should be of enormous value, as it will show those persons who can or can not be expected to respond. Even at present it is possible to condense the list considerably by discarding the cards of people whose interest is apparently in another direction.

The first school event was to be the dedication of the new building, the details of which were turned over to two farm clubs—one of men, the other of women. Three thousand personal invitations, the names obtained from the card index, were sent out from the school for the dedication exercises. The best possible speakers were obtained. The building was not nearly large enough to hold those who attended, so the exercises were held outdoors. The women's club served a luncheon

before the exercises to a large number of specially invited guests, and because the school owned no chairs everyone stood during the meal.

At about the same time posters telling of what the school had to offer appeared all over the county. They were nailed up on trees at crossroads, and on post-offices, blacksmith shops, schoolhouses, and even churches. The principal of the school believes in local advertising. Whenever a new organization or a series of meetings is to be attempted, the local and city papers receive full information; consequently the school has much free publicity, all of which has aided its work.

MEETINGS FOR RURAL SCHOOL TEACHERS.

The community work started almost as soon as the regular classes. The first work undertaken was a series of monthly meetings for rural-school teachers. It seemed desirable to introduce elementary agriculture into the rural one-teacher schools, but difficulty had been experienced because of the feeling of incompetence on the part of the teachers. To overcome this, in part at least, the rural teachers were invited to the agricultural high school for an all-day session on one Saturday each month. The morning was spent on lessons in general school methods and administration given by experts furnished by the county school authorities. Each teacher brought a basket lunch and all ate together in the domestic science kitchen. The school served hot coffee or tea, some of the high-school girls attired in their cooking uniforms acting as waitresses. The afternoon was devoted to agriculture. The teachers were given one general lesson from a textbook and then went to the agricultural laboratory, where an exercise was carried through by each teacher. Care was taken to have these exercises such as could be repeated in the rural schools without expensive apparatus. The object was not only to familiarize the teachers with methods and subject matter, but also to make them realize that real agricultural lessons were possible in their schools under existing conditions. At the same time, lessons in elementary agriculture, written by the principal with a view to local conditions, were printed in the monthly issues of a local educational publication, which is sent free by the school authorities to every teacher in the county. By means of these lessons and the meetings at the school it was hoped that agriculture could be gradually introduced.

The meetings were not successful. Transportation facilities were bad for those teachers coming from a distance. One teacher wrote that she could not get a horse to drive, and although she would gladly walk the 10 miles each way necessary to reach the railroad, she could hardly do so and catch the 6 o'clock train for the school. Others did from their slender salaries hire teams and a driver and then came 20 miles across country to attend the meetings. These could

FIG. 1.—CHILDREN IN LINE FOR A FIELD DAY.

FIG. 2.—JUDGING DRAFT HORSES AT A FARMERS' MEETING.

AGRICULTURAL HIGH SCHOOL OF BALTIMORE COUNTY, MD.

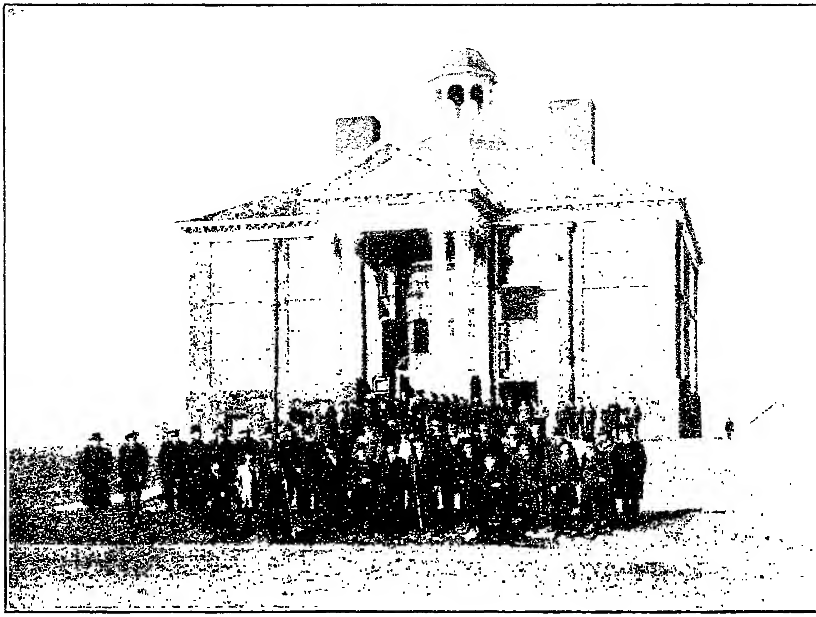

FIG. 1.—FARMERS' INSTITUTE AT THE MANASSAS (VA.) AGRICULTURAL SCHOOL.

FIG. 2.—BOYS OF CECIL COUNTY (MD.) AGRICULTURAL SCHOOL SPRAYING A NEIGHBORING ORCHARD.

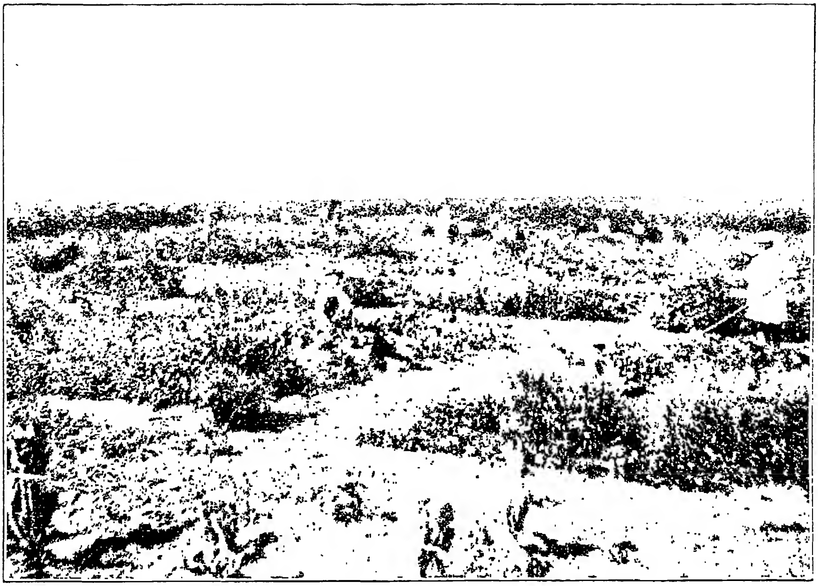

FIG. 1.—SCHOOL GARDEN, WITH FIELD OF PUREBRED CORN IN BACKGROUND.

FIG. 2.—SHORT WINTER COURSE FOR YOUNG MEN, CANBY (MINN.) AGRICULTURAL HIGH SCHOOL.

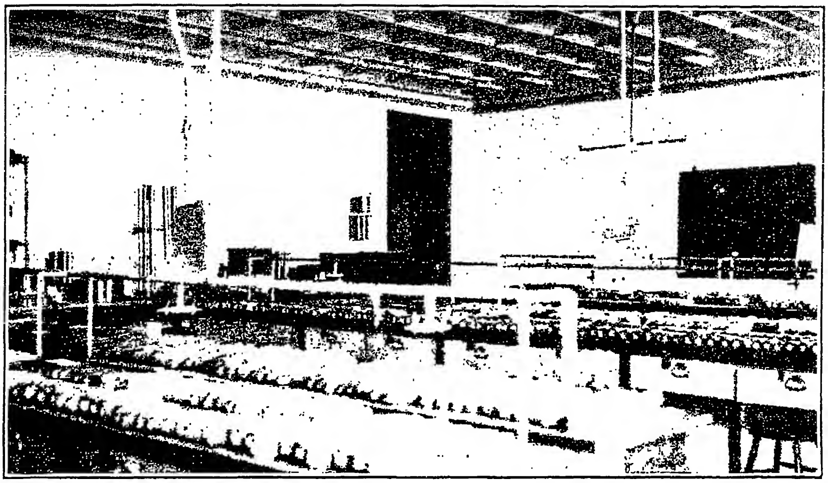

FIG. 1.—THE AGRICULTURAL LABORATORY, WITH A GLIMPSE OF THE CORN SHOW. 1,800 EARS FROM 1. AGRICULTURAL HIGH SCHOOL OF BALTIMORE COUNTY, MD.

FIG. 2.—A BOY WHO TRANSFORMED A SWAMP INTO A CORN FIELD. ONE OF THE HOME EXPERIMENTS. AGRICULTURAL HIGH SCHOOL OF BALTIMORE COUNTY, MD.

hardly be expected to keep that up indefinitely. Then, too, the weather combined to make conditions as bad as possible. One teacher came 30 miles to attend a meeting when the air was blinding with snowflakes and the drifts were knee-deep. She ought not to have come. Ultimately the principal felt sorrier for those rural teachers than he did for the lack of agriculture in the schools, so ceased holding meetings in the winter months. Another plan will be devised next year.

EVENING LECTURES FOR FARMERS.

A course of ten evening lectures for farmers was projected during the winter months. The school could not give a short course of any description during school hours because there were not teachers enough. The solution appeared to be a course of evening lectures, although there did not seem to be any definite demand for such a thing. Those who were asked if such a course would succeed said they did not know, or else that "maybe they would attend once or twice." It was decided to make the attempt, although the principal, who was to be the lecturer, was seriously advised to limit the projected course to five instead of ten lectures, because then a failure would not be so disastrously apparent.

It was decided to lecture on "soils and fertilizers," not that the principal knew more of that than of other branches, but because the people seemed to know less and wanted the information. A new issue of posters was printed setting forth the time, date, place, and subject of the lectures, and these were placarded all over the county. The lectures were to be illustrated by experiments continued throughout most of the course. Although alphabetically simple to the chemist, physicist, and soil technologist, the experiments vitally interested the people. Those lamp chimneys and Bunsen flames hypnotically held those in attendance while the talks went on. Outlines for each lecture were made by mimeograph and distributed to each person. The audience was requested always to bring the previous outlines to the lectures for reference. The evenings were understood to be serious affairs, designed for those who wanted to know and not as an entertainment for the curious. As projected they were for men, but the women asked to be allowed to attend and many did so throughout the course. The first lecture was attended by 60 persons, the second by 90, the third by 100, and so on. For the entire course, during good weather and bad, the attendance averaged 125 persons for each lecture, and this in an open farming country where practically everyone had to drive through the dark over ice, snow, and slush. There was no doubt about the success of this undertaking. At a spring meeting of a farmers' club a question was asked about the advisability of a certain soil treatment. At once came the answer

from another farmer: "If you had attended the lectures last winter at the agricultural high school you would not have to ask that; you would know!"

CORN CONGRESS.

After the close of the course of lectures a "corn congress" was planned, corn being one of the chief crops of the county. Nothing of the kind had ever been held in the State before, but therein lay its charm. The affair was to last two days, with morning, afternoon, and evening sessions each day. Speakers were secured from the United States Department of Agriculture and from the Maryland State Agricultural College and Experiment Station. Twelve speakers, some of the best in the country, were engaged for the series of six sessions. All the addresses were to be directly on corn growing and cooking, for the women too were to have addresses and demonstrations. Posters again were issued, always printed in red on white paper—the school colors—and all persons, clubs, granges, and schools were invited to enter exhibits of 10 ears of corn in the show. It was pointed out again to the principal that there were only enough persons in the neighborhood to make one good-sized audience and that while they might attend a single session they would not come to more. The result would thus be that either all would attend the best advertised address and leave the others to be given to empty seats, or else that there would be only a few people at each session. The outcome was different, for all sessions were well attended. People came and stayed throughout the two days, only going home to sleep. In all, over 180 exhibitors each sent in 10 or more ears of corn and almost 1,000 persons attended the sessions (Pl. VI, fig. 1). Twenty rural schools held small preliminary shows of their own and sent the best exhibits to the corn congress. Simultaneous meetings in different parts of the same building were held for men, women, and children. Meals were served at a lunch counter by the ladies of the women's club, who again came to the aid of the school; the proceeds of this went to the school. For the corn show only ribbon prizes were awarded, although the city stores would have been willing to contribute cook stoves, carpet sweepers, washing machines, and like articles for prizes. At the close of the last session, the prize exhibits of corn were sold at auction to the highest bidders. By this means good seed corn was distributed throughout the neighborhood. The corn congress was a success. Everybody began planning for a bigger, better, and busier one the next year.

SHORT COURSES FOR WOMEN.

For the women a series of monthly meetings was held on Saturday afternoons. Using a card list again, postal cards were sent out to 300 women living within driving distance of the school. The three school

wagons were run over the regular routes to bring them to the meetings. Thus many women who would have been unable because of the farm work to secure a man and team to take them to the school were enabled to attend. The meetings opened by a general session at which one person spoke for fifteen minutes. This person was always some one of prominence and ability—some one vitally concerned in the world's work. This was followed by music. The musicians and speakers always contributed their services and usually came from the city. Following the general meeting, the women divided into four groups, which were self-chosen and continuous throughout the year. At the end of each year the groups will change. The first group is for the study of domestic science. The women do not attend a demonstration, but each works with the individual equipment placed at her disposal. Nickle-plated cook stoves, bright pans, and clean china add to the attractiveness of the work. It is the same type of study given the children. The second group does carpentry work in the manual training room. The women are taught to saw, plane, hammer, and do other simple operations. It will not be necessary for those women to wait until their husbands find time to build the chicken coops. The third group is known as the group in home crafts. Instruction is given in chair caning, rug weaving, Indian basketry, stenciling, etc. The fourth group takes up a study of modern literature. It is designed for those persons who prefer to find in the meetings an opportunity for rest and enjoyment. Various modern authors are successively considered with readings from each. The meetings have had an average attendance of 85 at each meeting and are well filling the place for which they were intended.

YOUNG PEOPLE'S LITERARY SOCIETY.

A literary society has been formed for young people in the neighborhood who happen to be too old to go to school. The society meets once in two weeks and has a membership of about 100 persons who pay dues for its maintenance. Spelling bees, debates, and other so-called literary exercises are held and serve to engender a better neighborhood spirit while enlivening the long winter evenings.

STUDENTS' HOME EXPERIMENTS.

During the summer the school conducts experiments on the home farms of its pupils. All boys in the high-school department are expected to perform at home an experiment of their own selection during the summer vacation. This is in order to bring the work of the school to the people at large, as well as to emphasize concretely the instruction of the winter in the mind of the student. The experiments, scattered over a territory 25 miles long by 5 miles broad, attract much attention among the neighbors and are an efficient demon-

stration of agricultural ideas. They range over many subjects, according to the choice of the student. Many are variety tests of corn from seed furnished by the school, the corn being grown under modern methods by the student (Pl. VI, fig. 2). Other students are testing herds of dairy cows, weighing and recording the milk at each milking, and making frequent Babcock tests of the butter-fat content. Some students are growing an acre of alfalfa, while still others conduct a variety test of cowpeas or of popcorn. The experiments are closely watched from the school, the principal visiting them frequently during the summer and advising the students concerning them. This brings the principal in touch with the home life of the students and gives the boys the impetus necessary, sometimes, to carry on a flagging experiment.

OTHER FEATURES OF COMMUNITY WORK.

The school tests seeds and milk for farmers. During the early spring months many samples of clover seed were submitted for a determination of the weed seeds present and of the germinative ability of the sample. Throughout the entire year milk and cream are tested for the butter-fat content. Since many farmers in the neighborhood sell their product by the amount of butter-fat contained, it is highly desirable that they have occasionally an authoritative test from a disinterested source with which to compare the tests made by the dealer. The school furnishes this test.

With the activities throughout the neighborhood emanating from the new school it was but natural that there should be a renewed activity along lines of religious organization. A long-disused chapel was opened, a committee of ten young men appointed by the principal, and regular Sunday night meetings for young people were held. The people looked naturally to the school to form the organization, supply the enthusiasm, and lead in the work. About 100 young people attend the meetings, which are undenominational in character and marked by their enthusiasm.

The community work of the school has not proved of unusual difficulty, nor has it disclosed obstacles which make it prohibitive for any school anywhere. On the contrary, the work has proved easier than seemed possible and more successful than appeared probable. Many of the dilemmas conjured up by pessimistic advisers never materialized. From this experience it seems certain that every agricultural high school in the country—even those like this with a small faculty, small funds, and a small building—can make a success of community work.

SUPPLY AND WAGES OF FARM LABOR.

By George K. Holmes,

Chief of Division of Production and Distribution, Bureau of Statistics.

NUMBER OF PERSONS ENGAGED IN AGRICULTURE.

MOVEMENT FROM THE FARM.

Industrialism and city expansion have advanced in this country in greater degree than agriculture. The lure of the city and the city's illusion of higher wages are robbing the farm of its laborer and of the farmers' children who would otherwise be the potential farm owners of the future.

The more or less imperfect census record is the only information possessed in regard to the number of persons engaged gainfully in agriculture in this country. It is very considerably an imperfect record previous to the census of 1900, for the reason, principally, that enumerators often reported agricultural laborers as laborers without any designation of kind of work done by them, and for this reason the agricultural element in the population is represented as being less than the fact. It may be that in some small degree this observation applies to the census of 1900.

In 1820 the number of persons of both sexes reported as being engaged in agriculture was 2,068,958, including slaves, and with the same inclusions the number for 1840 was 3,719,951; by 1880 the number had increased to 7,663,043; by 1890 to 8,466,363; and by 1900 to 10,249,651 (census report on occupations). In the later censuses the persons are described as having been employed gainfully, a distinction not made in the earlier ones. The statements are for the contiguous States and Territories of the Union.

The agricultural element was 83.1 per cent of persons having occupations in 1820; 77.5 per cent in 1840; for gainful occupations, 44.1 per cent in 1880; 37.2 per cent in 1890; 35.3 per cent in 1900. For 1910 the inference is that one-third or less of the persons having gainful occupations are embraced in the agricultural class.

Agricultural laborers constitute one of the primary classes of occupations, and their number, as before stated, has been reported by all censuses as below the fact because the enumerators have reported many of them as general laborers. Another element of error has been

the reporting of negro "croppers" in the South in the census of 1870 and subsequent ones as farmers, whereas they would have been more properly designated as farm laborers, since they worked for wages, although the wages were contingent. Taking the record as it stands, the number of agricultural laborers in 1880 was 3,323,876; in 1890 it was 3,004,061; in 1900, 4,410,877. The erroneous character of the census enumeration with regard to agricultural laborers appears when it is observed that they were represented as being 43.4 per cent of all persons engaged gainfully in agriculture in 1880; only 35.5 per cent in 1890; and 43 per cent in 1900.

Analysis of the occupation figures of the census of 1900 discovers that 12.3 per cent of all persons having gainful occupations in the North Atlantic division of the States was engaged in agriculture; 26.1 per cent in the Western division; 36.3 per cent in the North Central division; 49.9 per cent in the South Atlantic division; and 62.8 per cent in the South Central division, the average for the United States being 35.3 per cent. Agriculture as an occupation is of least account, relatively, in New England, New York, New Jersey, and Pennsylvania, the group of States constituting the North Atlantic division, and is of greatest account in the lower section of the Mississippi Valley, constituting the South Central division.

Subject to the imperfections of the record, the agricultural laborers in 1900 were 35.2 per cent of all persons gainfully engaged in agriculture in the North Central States, 36 per cent in the Western States, 39.3 per cent in the North Atlantic States, 47.8 per cent in the South Central States, and 52.5 per cent in the South Atlantic States—the lowest percentage being found in the North Central States and the highest in the South Atlantic.

The agricultural element in the population, as indicated by the occupation statistics of the census, is relatively a diminishing one, and it is generally believed that the agricultural laborers, or those who work for hire, are a diminishing relative element in the agricultural population, although this does not appear in the imperfect census record.

MACHINES INCREASE THE PRODUCTIVENESS OF LABOR.

The reason why agricultural labor could decline relative to National consumption of agricultural products and still leave an enormous National surplus for export is forcibly expressed in the report of the United States Bureau of Labor concerning hand and machine labor, issued some years ago. The facts established in that report warrant the conclusions that follow.

From 1855 to 1894 the time of human labor required to produce 1 bushel of corn on an average declined from four hours and thirty-four minutes to forty-one minutes. This was because inventors had

given to the farmers of 1894 the gang plow, the disk harrow, the corn planter drawn by horses, and the four-section harrow for pulverizing the top soil; because they had given to the farmer the self-binder drawn by horses to cut the stalks and bind them; a machine for removing the husks from the ears and in the same operation for cutting the husks, stalks, and blades for feeding, the power being supplied by a steam engine; because they had given to the farmer a marvelous corn sheller, operated by steam and shelling 1 bushel of corn per minute instead of the old way of corn shelling in which the labor of one man was required for one hundred minutes to do the same work.

In the matter of wheat production, 1894 being compared with 1830, the required human labor declined from three hours and three minutes to ten minutes. The heavy, clumsy plow of 1830 had given way to the disk plow that both plowed and pulverized the soil in the same operation; hand sowing had been displaced by the mechanical seeder drawn by horses; the cradling and thrashing with flails and hand winnowing had given way to reaping, thrashing, and sacking with the combined reaper and thrasher drawn by horses.

Herein lies the strength of the horse as an economic animal. He has been assailed by the bicycle, the electric street and suburban car, and by the automobile, but all combined have not prevented horses from increasing in numbers and in value. As a source of farm power and as a substitute for human labor in combination with machines, the horse's economic place on the farm is more strongly established than ever before.

IMMIGRATION NOT CONTRIBUTING MUCH TO FARM LABOR.

Immigration contributed much to the agricultural population until the supply of cheap and otherwise desirable public land was nearly exhausted. At the present time, when land that immigrants can readily utilize for agriculture is high priced, they are not contributing appreciably to the agricultural population. During the year ending June 30, 1908, the immigrant aliens admitted to this country numbered 782,870, of whom, or their equivalent, 50 per cent returned to their native countries on account of the industrial depression they found here; the number arriving in the fiscal year 1909 was 751,786, of whom 30 per cent returned; and in 1910 the arrivals were 1,041,570, of whom 17 per cent did not remain.

By means of census publications, the white foreign-born agricultural laborers, as an element of the total white agricultural laborers, may be determined. In 1890 the white foreign-born element was 13.1 per cent of all white agricultural laborers, and the percentage declined to 8.5 in 1900. In the latter year only 258,479 agricultural laborers were foreign-born whites in a total of 3,038,884

white agricultural laborers. The white foreign born as an element of the total white agricultural laborers was 0.6 per cent in the South Atlantic States in 1900; 2.6 per cent in the South Central; 11.8 per cent in the North Central; 15.6 per cent in the North Atlantic; 20.9 per cent in the Western.

If the number of agricultural laborers of foreign parentage be taken for 1900, and this number includes many laborers who were American born, it appears that they are 17.4 per cent of all agricultural laborers; but the percentages vary widely among the geographic divisions—in the South Atlantic division, 0.8 per cent; South Central, 3.6 per cent; North Atlantic, 30.4 per cent; North Central, 40.7 per cent; and Western, 48 per cent.

LABOR OF WOMEN DECLINING.

Women, as contributing to agricultural labor, are taking a smaller and smaller part, both relatively and absolutely. The census record gives 534,900 women as performing agricultural labor for hire in 1880; 447,104 in 1890; and 663,209 in 1900. The apparent tendency expressed by these numbers is unbelievable and is directly contrary to a Nation-wide acquaintance with the conditions of agricultural labor in this country. The deficiencies of the earlier censuses can not be estimated, and it may be assumed that the number of female laborers reported in 1900 is near the fact.

The female element of agricultural laborers for hire in 1900 in the total number of women engaged in agriculture is largest in the South Atlantic States, for which the percentage is 79.9; for the South Central States the percentage is 76.5; North Central, 13.5; Western, 12.8; North Atlantic, 11; the United States, 67.9.

In 1900 women were 10.9 per cent of all persons gainfully engaged in agriculture. Among the geographic divisions, the South Central States were highest with 35.6 per cent, and the South Atlantic follows with 25.8 per cent. The North Central percentage is 0.07; Western, 0.02; North Atlantic, 0.01.

As an element of negro agricultural laborers for hire, the female laborers are represented by 37.9 per cent in the United States for 1900; 40.6 per cent for the South Central States; 36.4 per cent for the South Atlantic; 1.3 per cent for the North Central; 1.2 per cent for the Western; and 0.6 per cent for the North Atlantic.

Dependence must be placed upon the general knowledge of conditions with regard to female labor on the farm. The outdoor work of white women on farms of medium or better sorts has greatly declined from early days, and the decline has been rapid during the last generation. Farmers' wives and daughters no longer milk the cows and work in the field and care for the live stock as of yore; they do not work in the kitchen and garden as before; nor assist in the fruit and

berry harvest. They are making less butter, and cheese making on the farm has become a lost art. They may care for the poultry and the bees, do housework and gather vegetables for the table, and cook and keep the dwelling in order. This is substantially the limit. Of course negro women do much labor in the cotton field, but this diminishes year by year.

THE NEGRO ELEMENT.

It is not advisable to base any fine distinctions upon the censuses of 1890 and 1900 with regard to negroes employed in agriculture. But the comparison may indicate numerically the drift of negroes in their relation to agriculture. In 1890 the negroes who were gainfully engaged in agriculture numbered 1,704,904, and in 1900 they numbered 2,108,980, an increase of one-half of 1 per cent in their ratio to the entire number of persons gainfully employed in agriculture. The negro agricultural laborers of 1890 numbered 1,006,728, and in 1900 they numbered 1,344,116, or a decline from 64.9 to 63.7 per cent in their ratio to negroes of all agricultural occupations.

Negro farm labor in the South presents special problems which southern farmers fully understand. The census of 1900 disclosed the fact that negro labor was leaving the farm and migrating to town and city, to the railroad, to the logging and lumbering camp. The negro is still a necessity to southern agriculture, but he is gradually yielding his place to white labor. One of the old arguments in favor of slavery was that a white man could not work in a field under the southern sun, and it is still a common belief in the North that southern farm labor is performed almost exclusively by negroes. This, however, is not the fact. More than half the cotton crop is raised by white labor; in Texas three-fourths or more. In the sugar and rice fields white labor is common and in some places all but exclusive. Negroes are often disposed to migrate in pursuit of chimeras, so that they are easily induced to go to other parts of the country when employment is promised to them, and agents to promote their migration are found where States have not taxed them out of occupation or made it a criminal offense.

If negroes and whites be combined, the negroes will be found to represent 13.7 per cent of all persons in all gainful occupations in 1900, 20.6 per cent of all persons engaged gainfully in agricultural occupations, and 30.5 per cent of all agricultural laborers. The percentages are almost exactly the same for 1890, except that the negro agricultural laborers were 36.8 per cent of the white and negro total, so that there was apparent decline in the negro element of agricultural laborers from 1890 to 1900.

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INVESTIGATIONS BY THE BUREAU OF STATISTICS.

THE FIRST OF NINETEEN BEGAN IN 1866.

The subject of the wage rates of farm labor was first systematically investigated in this country by the Bureau of Statistics of the Department of Agriculture in 1866. The investigation was repeated with variations every few years until the latest one in 1909. The results of nineteen investigations are of record, covering the period of forty-four years, beginning with the abnormal conditions at the close of the civil war and passing through the two severe industrial depressions of 1873–1877 and 1893–1897, and the less severe depressions of 1884–86, 1903–4, and 1907–8.

From the beginning of this period to about 1897 agricultural overproduction was frequent. Immense areas of new public land came into cultivation, and farmers were painfully in debt, and often the prices of products were unprofitable, if not positively below the cost of production. Since 1897, and more especially since 1902, the financial condition of farmers has much improved. All of the conditions mentioned may be related to the wages of farm labor, and, in fact, apparently have been.

In the statement of wage rates, contained in this article, all original rates during the currency period 1866–1878 have been converted to gold. Some of the investigations were made in the spring with no explanation whether the published rates represented the current year or the preceding year; indeed, some of the wage rates, as, for instance, the rates of day labor in harvest, must necessarily have belonged to the preceding year. In another case two investigations were made, but the published results were combined. These statements account for the use of a double year in several instances.

WAGE RATES OF MEN PER MONTH.

The average wage rate of $15.50 was paid for the labor of men on farms per month, in hiring by the year without board, in the United States in 1866. This average rate was maintained in 1869, after which there was an increase to $17.10 in 1875; to $18.52 in 1880 or 1881; to $19.22 in 1885; and in 1909 to $25.46. During the entire period the wage rate increased about two-thirds. From 1866 to 1909 the increase in the North Atlantic States was from $22.04 to $30.89; in the South Atlantic States, from $10.67 to $18.76; in the North Central States, from $20.39 to $30.55; in the South Central States, from $12.57 to $20.27; and in the Western States, from $40.28 to $44.35, a rate of increase in the last-mentioned group far below that of the other divisions.

The foregoing are money rates of wages, and do not include supplemental wages not expressed in money which are more or less cus-

tomary in all parts of the country. Among the items of supplemental wages are use of dwelling, often with garden and accommodations for cow and swine; wood for fuel; pasture for cow, horse, or swine; and other items.

For only two years, 1866 and 1909, was the wage rate ascertained for the outdoor labor of men per month in hiring by the season without board, and the rates are higher than they are for hiring by the year. In 1866 the average rate was $18.08; in 1909, $28.22.

The highest monthly rate, in hiring by the season, paid in any geographic division in 1909 was $48.04 in the Western; after which follow in order, $35.11 in the North Atlantic; $33.64 in the North Central; $22.48 in the South Central; and $20.86 in the South Atlantic.

During the period 1890–1906 wage rates were not ascertained for hiring by the year and season separately, but for the two combined, and the hirings were combined for 1909. During this period monthly wage rates in hiring for the season and year combined, without board, increased from $19.45 to $27.43. The increase in the North Atlantic division was from $24.72 to $33.68; in the South Atlantic from $13.94 to $20.13; in the North Central from $22.25 to $32.90; in the South Central from $16.10 to $21.85; and in the Western from $33.96 to $47.24.

RATES PER DAY.

Every one of the nineteen investigations of the wage rates of farm labor included the rate per day in harvest work with board. At the beginning of the period, in 1866, the rate was $1.04 and the increase was to $1.18 in 1875, followed by a decline to $1.04 at the end of the industrial depression of that time, after which there was an advance continuously to $1.20 in 1882; but the depression of 1884–1886 and a period of overproduction and low prices for farm products reduced the rate below that of 1882 until, in the depression of 1893–1897, the rate was as low as 96 cents, after which there was a marked advance to $1.45 in 1906 and a rate of $1.43 in 1909.

Among the geographic divisions in 1909 the highest wage rate for harvest work with board was $2.02 in the Western States, after which follow in order, $1.87 in the North Central States; $1.62 in the North Atlantic; $1.10 in the South Central; and $1.03 in the South Atlantic.

In the North Atlantic division the rate increased throughout this period, 1866–1909, from $1.32 to $1.62; in the South Atlantic division from 79 cents to $1.03; in the North Central States from $1.31 to $1.87; in the South Central States from 92 cents to $1.10; and in the Western States from $1.93 to $2.02.

Lower rates than the foregoing were paid for day labor in other than harvest work with board. The average for the United States

begins with 64 cents in 1866, followed by fluctuations similar to those of harvest wages, and ends the period in 1909 with $1.03.

The gain during the forty-four years was from 86 cents to $1.16 in the North Atlantic division; from 43 cents to 73 cents in the South Atlantic; from 83 cents to $1.32 in the North Central; and from 55 cents to 82 cents in the South Central; while on the contrary there was a decline from $1.49 in 1866 and $1.50 in 1869 to $1.48 in 1909 in the Western States.

INDUSTRIALISM, TRADE, AND TRANSPORTATION.

Several causes affecting farm wages were investigated in 1909. In the matter that follows dependence was placed on the census of 1900, except for the rates of wages. Farm wages are high in States in which there has been large development of manufacturing, mining, mechanical pursuits, trade, and transportation in comparison with States poorly or less developed in these directions, and conversely wages are lower in those States in which agriculture is predominant than in States where it is a subordinate industry. States in which the urban population is a large percentage of the entire population are those States in which the wages of farm labor are higher than in those in which urban population is of minor account.

RELATION BETWEEN PRODUCTION AND WAGE RATES.

Necessarily in the long course of time the employing farmer must depend upon the value of his products for the wages that he pays to his laborers. He can not go on indefinitely paying wages out of capital, but he must in the general experience pay them out of farm products. Hence it follows as a matter of inference that farm wages may be higher in those States in which the value of the products per worker is higher than in those States in which the value of products per worker is lower.

This conclusion is amply substantiated in the investigation of farm wages in 1909. The highest wages are paid in the Western division of States, and in this division the average value of farm products per agricultural worker in 1899 was $759. Next below this division in both rate of wages and average value of farm products per worker, $678, is the North Central division; and third in order in both respects is the North Atlantic division. The South Central division is fourth in order in both rate of wages and value of products per worker, which is $271; and last of all is the South Atlantic division in both respects, the average value of products per worker being $233. These values stand for gross amount of products, and not for net wealth produced.

WAGES SUPPLEMENTARY TO MONEY RATES.

The nominal money rate of wages paid for farm labor by no means fully represents the real wages received by the laborer. There are two important additions to the nominal money rate of wages which enter little if at all into the thoughts and plans of agricultural laborers. A farm laborer receiving, say, $30 per month, as he did in the North Atlantic and North Central States in 1909, often receives supplemental wages in the form of use of dwelling and garden, accommodations for cow, pigs, and poultry.

The value of the supplemental wage allowances was investigated in all parts of the United States, with the result that their estimated value per month is relatively a large addition to the nominal rate.

In the case of the man receiving $30 in money wages, the rental value of dwelling and appurtenances would probably be about $3.25 to $4.50. If the farm laborer gets firewood as an item of supplemental wages, its reported value per month ranges from about $1.06 to $2.39, the latter figure being applicable to the $30 laborer in the North.

It often happens that the laborer receives supplementary to his money rate of wages the privilege of pasturing his cow, horse, or swine, and the estimated monthly cost of this as an average for the United States is from 65 cents to $1.61. Or, there may be an allowance for feed outside of pasturage for cow, or horse, or swine, or poultry, and the cost of this as established by this investigation ranges from $1.11 to $3.11.

A very common supplementary wage allowance in some parts of the country, especially in the North Central States, is the frequent use of a horse and buggy by the farm laborer. The monthly value of this has been estimated by the correspondents of the Bureau of Statistics in all parts of the United States, with the result that it ranges from 87 cents to $2.37. Or, the laborer may own a horse, and stabling and feed are provided by his employer in addition to the money rate of wages. For this service it is estimated that the cost ranges from 45 cents to $2 per month throughout the entire country.

Perhaps the laborer's family also receives without specific charge a considerable quantity of fruit. The value of this fruit is estimated on a monthly basis, although it may have been received within one season, and ranges from 62 cents to $1.64 monthly throughout the year. If the laborer is a single man, his employer hires a woman to do his laundry work as a part of the family wash, and the value of this service is estimated to range from 75 cents to $2 per month.

No laborer receives all of these supplemental wages, but it often happens that he receives more than one item of them. If he is a man of family, an increase of his monthly money rate of wages by $5

to $10 worth of supplemental allowances and even more is not uncommon in many States.

ADVANTAGE OF FARM WAGES IN PURCHASING POWER.

If the farm laborer is comparing his nominal rate of money wages with the similar rate of the motorman or conductor of the electric railway who lives in the city, he must take into consideration the less costly living that he gets on the farm. In some respects it is a better living, against which of course there must be made a set-off of features that are in some respects worse.

The farm laborer gets many things at prices which are as low as wholesale prices in the motorman's city, and sometimes lower. He can get his supply of poultry at low prices, if he does not produce it himself; and so with eggs, milk, and butter; sometimes flour and meal; very likely potatoes and other vegetables and fruit. At low prices he may also get fresh and salt pork, his fuel and, in many parts of the country, his tobacco. If he pays rent for his dwelling, he will pay, say, $40 per year, whereas the motorman with a family pays $150.

All things considered—the allowances received by the farm laborer supplemental to the money rate of wages and the lower cost of many things that he buys as compared with the cost in the city—the farm laborer receiving nominally $30 per month really gets, in comparison with his situation as it would be if he lived in the city, perhaps more than the motorman or street-car conductor gets, and very likely in most cases a larger amount than he would be likely to earn in any occupation open to him in the city.

The money wage rates of farm laborers have increased in a marked degree within the last few years, and in this respect a comparison may be made with the wages of workingmen. A still further comparison may be made between the purchasing power of the wages of the farm laborer in terms of food and the purchasing power of the wages of workingmen. The investigations of the United States Bureau of Labor make possible this comparison.

If the mean wage rates of agricultural laborers for the years 1890–1898 be regarded as 100, the rate per month of the outdoor labor of men on farms in hiring by the year and season in 1890 is represented by 100.9. The relative number increased to 103.6 in 1893, and there was a sudden decline to 96.3 in 1894, after which there was an unbroken increase in this relative number until in 1907 it was 141.1.

The purchasing power of the wages of the farm laborer in 1907 in terms of actual food consumption in comparison with the mean of 1890–1898 is represented by the comparative number 117.1. In 1907 the corresponding relative number standing for the wages of the workingman was 122.5 and the purchasing power of his wages in

terms of actual food consumption in 1907 is represented by the relative number 101.7, as compared with the mean of 1890–1898 which, as before stated, is represented by 100.

As time advanced after 1890 the farm laborer, setting out with wages having a relative purchasing power in terms of food about equal to that of the workingman, passed him in this respect in 1899, and rapidly gained upon him in subsequent years.

QUALIFICATIONS OF LABORERS TO BECOME TENANTS.

In the investigation of farm wages in 1909 inquiries were made to ascertain to what extent male outdoor farm laborers were qualified to become farm tenants. In the opinion of the correspondents who supplied answers, 48 per cent of the laborers of the South Central States are so qualified; 46 per cent in the North Central States; 37 per cent in the Western; 35 per cent in the South Atlantic; and, lowest of all, 33 per cent in the North Atlantic States.

ABILITY OF LABORERS AND TENANTS TO BECOME OWNERS.

Correspondents were asked whether it was reasonably possible for farm laborers and tenants to save enough to buy a farm that would support a family even with the help of a mortgage, and their replies indicated that 72 per cent of farm laborers and tenants find it reasonably possible to acquire farm ownership. The percentages for the geographic divisions are all over 70 and under 80—a remarkably uniform condition of affairs with regard to this matter throughout the United States.

SMALL MOVEMENT FROM CITY TO FARM.

The movement from city to farm for the purpose of permanent farm life and labor, either for hire or under ownership, has hardly become general enough in this country to present recognizable proportions. There is a little of this movement here and a little there, but nearly all cases are sporadic.

But there is one sort of labor that goes from city to farm which has become large enough to be perceptible, and that is seasonal labor for employment, not in general farming operations, but for special purposes. The migration of men from cities to follow the wheat harvest from Oklahoma to North Dakota is the best known feature of this sort of farm labor. It is not so generally known that women and children and some men, too, go from the city to the farm at certain seasons to harvest cucumbers to be sold to the pickle factory; to pick, grade, pack, and dry fruits; to harvest hops and berries, and dig potatoes, and so on with other crops that need a rush of labor at time of harvest. Some labor of this sort is applied also to the cultivation

of crops, as in pulling weeds from beets and onions, but this labor does not seem to be used much for cultivating crops and not at all for planting.

HOLDING THE COUNTRY POPULATION TO THE SOIL.

There are no indications that the town and city population will supply any considerable part of the agricultural labor of the future. At any rate, the farmer would not need to get his labor from the cities if he could hold the country population to the soil, and the recognition of the importance of retaining the children on the farm and of keeping country labor from migrating to cities is governing most of the work by Nation and States in behalf of agriculture.

The old practice was to trust to the printed page for the instruction of the farmer, but in the course of time it was found that this was poorly productive of results. Then followed the farmers' institute movement, which consisted of lectures; sometimes later with practical demonstrations.

In the meantime the United States Department of Agriculture and the experiment stations got into more practical lines of work by means of special advice in particular cases, formerly by mail and now also by personal visits; so that it has been discovered that the most successful promotion of agricultural knowledge and practice is caused by practical demonstration under the observation of the farmers to be instructed.

The largest exponent of this latter plan of instruction is the farmers' cooperative demonstration work, maintained in the South by the Department of Agriculture with outside financial assistance and with the effective help of farmers and planters, without whose aid it would be a failure.

Along with the foregoing is the very recent movement to instruct country children in agriculture at the beginning of their school life and to continue this instruction in the high school and the college. In this way the foundation will be laid for successful farming, and such farming implies the retention of children upon the farm.

Still further and to the same end, many agencies are at work upon the country people to improve their dwellings, their modes of living, their home life and their social life, which are already beginning to count against the unpleasantness of country life and in favor of making such life attractive. Influences of this sort, joined to the agricultural education of the young and to the practical teaching of the farmer how to do by doing, at the time when farming is prosperous and profitable, may be depended upon to save to our agriculture all the labor it will need for the maintenance of our National self-sufficiency.

INSPECTION OF IMPORTED FOOD AND DRUG PRODUCTS.

By R. E. Doolittle,
Chief New York Food and Drug Laboratory, Bureau of Chemistry.

LAWS GOVERNING IMPORTED FOOD AND DRUG PRODUCTS.

The Food and Drugs Act, June 30, 1906.

The food and drugs act of June 30, 1906, which, as stated in its title, is "An act for preventing the manufacture, sale, or transportation of adulterated or misbranded or poisonous or deleterious foods, drugs, medicines, and liquors, and for regulating traffic therein, and for other purposes," not only provides for the inspection of food and drug products of domestic manufacture that enter interstate commerce or are sold in the Territories or the District of Columbia, but also for the inspection, before entry into this country, of food and drug products produced in foreign countries and brought to the United States.

Section 11 of this act provides that foreign food and drug products entitled to entry into this country must not only comply with the requirements for domestic products, but must not otherwise be dangerous to the health of the people of the United States nor of a kind that is forbidden entry into or forbidden to be sold or restricted in sale in the country in which they are made or from which they are exported, or be falsely labeled in any respect. In other words, the foreign products must conform to the laws of this country and also to those of the country in which they are produced or from which they are shipped.

The Drug Law of 1848.

For the regulation of the importation of foreign food and drug products into the United States there are, besides the food and drugs act, which is general, covering all classes of food and drug products, several laws more specific in character, covering only one product or class of products. One of the most important of these laws is the act of Congress approved June 26, 1848, prohibiting the importation into the United States of adulterated and spurious drugs, medicines, and medicinal preparations. This act is more commonly known as the drug law of 1848.

Sections 2933 to 2935, and section 2937, (found on page 1936 of the U. S. Compiled Statutes, 1901, volume 2), give the detailed instructions for the enforcement of this law, covering the exportation of rejected articles, etc. The Attorney General of the United States [1] ruled that this act was not repealed by the food and drugs act of June 30, 1906, and as a matter of fact both the acts are enforced through the cooperation of the Department of Agriculture and the Treasury Department in the inspection of this class of merchandise.

THE TEA ACT.

The first law regulating the importation of tea into this country was passed on March 2, 1883; this was repealed by the tea act of March 2, 1897,[2] which, like the drug law of 1848, is enforced by the Treasury Department.[3] Thus far tea has been subject to inspection under this Act only, all importations being compared with the standards fixed each year by the Secretary of the Treasury, based on the standard samples submitted by a board of seven experts whom he appoints. Section 3, referring to the establishment of these standards, reads as follows:

SEC. 3. *Secretary of Treasury to establish standards.* The Secretary of the Treasury, upon the recommendation of the said board, shall fix and establish uniform standards of purity, quality, and fitness for consumption of all kinds of teas imported into the United States, and shall procure and deposit in the customhouses of the ports of New York, Chicago, San Francisco, and such other ports as he may determine, duplicate samples of such standards; that said Secretary shall procure a sufficient number of other duplicate samples of such standards to supply the importers and dealers in tea at all ports desiring the same at cost. All teas, or merchandise described as tea, of inferior purity, quality, and fitness for consumption to such standards shall be deemed within the prohibition of the first section hereof.

The following Treasury Decision shows the lines along which the two departments cooperate in tea inspection:

(T. D. 31224.)

EXAMINATION OF TEA UNDER THE FOOD AND DRUGS ACT.

Beginning May 1, 1911, tea imported thereafter must be labeled to show the presence of artificial coloring or facing matter.

TREASURY DEPARTMENT,
January 17, 1911.

To collectors and other officers of the customs:

At the request of the Secretary of Agriculture and upon his representations as to the necessity therefor, under the food and drugs act, the department

[1] Opinions of Attorney General, 1906–8, vol. 26, p. 311.

[2] United States Statutes at Large, 1895–1897, vol. 29, pp. 604–607.

[3] See Customs Regulations, 1908, Treasury Department, for complete regulations governing inspection of tea.

has decided to cooperate with his department to the end that packages of tea artificially colored or faced shall be so labeled.

I am advised by the Secretary of Agriculture that, beginning May 1, 1911, all tea thereafter imported into the United States, both in large and small packages, must be labeled on each container to show the presence of any artificial coloring or facing matter therein.

This regulation will not apply to teas imported prior to May 1, 1911.

It is expected that such examination as the Department of Agriculture desires to make under the food and drugs act, to determine the presence of such foreign matter, will be made simultaneously with the examination under the tea inspection act of March 2, 1897, in order that there shall be the least possible delay to shipments.

Should special regulations be required to minimize any inconvenience to importers and to secure harmonious cooperation between the two departments under the two laws governing the importation of tea, you will be duly advised.

FRANKLIN MCVEAGH,
Secretary.

INSPECTION BY DEPARTMENT OF AGRICULTURE.

Congress, in 1899, first authorized the Secretary of Agriculture to inspect foreign food products before their entry into the United States, but failed to make any appropriation for carrying on the work. The appropriation act of July 1, 1903, however, under the appropriation for the Bureau of Chemistry, provided funds for this work, and a clause of the act conferred upon the Secretary of Agriculture practically the same authority for the inspection of imported food products as is now conferred by section 11 of the food and drugs act. During the first year the principal work consisted in the sending out of information and instructions to the shippers of food products of the foreign countries and to importers of this country regarding the requirements of the act. Through the cooperation of the Department of State arrangements were made whereby there were sent to the Bureau of Chemistry copies of all consular invoices covering shipments of food products, to each copy of which was attached a declaration of the shipper as to the place of production and character of the products covered by the invoice. Samples for analysis were obtained from the collectors of customs at the ports of entry, by request upon the Secretary of the Treasury. It was soon found, however, that the time required to ship the samples to Washington and transmit the findings to the collectors so interfered with the handling of the importations by the Treasury Department that the plan was not practical. Congress, by act of July 1, 1904, having continued the provisions for the inspection of the imported foods by the Secretary of Agriculture, it was decided to establish branch laboratories at the principal ports of entry.

The first branch laboratory was opened at the port of New York, September 6, 1904. A new method for the inspection and sampling

of the products when same were in the possession of the examiners of the Appraisers' Department for classification purposes was devised. This system was found to overcome the delay and the following year branch laboratories were established at the ports of Boston, Philadelphia, Chicago, New Orleans, and San Francisco. Copies of the consular invoices covering shipments of food products to ports having no laboratory were sent direct by the consuls to the Bureau of Chemistry and from these such samples were ordered as were deemed necessary. Thus, at the time of the enactment of the food and drugs act of June 30, 1906, the Department of Agriculture already had in operation six branch laboratories situated at the principal ports of entry.

Since the passage of the food and drugs act laboratories have been installed at Buffalo, Cincinnati, Detroit, St. Paul, Kansas City, Savannah, Galveston, Seattle, Portland, Denver, St. Louis, Pittsburg, Omaha, Nashville, and Honolulu. The work of these laboratories, however, is not confined to the imported products. The inspection and analysis of domestic products as well as the imported constitute the work of these laboratories. A plan has been devised whereby shipments of food and drug products presented for entry at ports having no laboratory are reported to the laboratory of that customs district, and it may be said that a very complete system for the inspection of food and drug products of foreign production before their entry into the United States is now in operation. It should not be inferred from this that every individual shipment of food or drug product is inspected before it is permitted to enter the country. This would require a force of inspectors and chemists greatly outnumbering all now employed for the inspection of both the domestic and imported products. Those products most subject to adulteration are the most closely inspected and the range of products extended as circumstances and the data collected indicate the desirability of paying special attention to certain classes of foods.

Investigations both as to composition of products and methods for the detection of adulterants are constantly under way, and upon the findings are based new rules and regulations for insuring the purity of the products. Products or classes of products seldom sophisticated are only occasionally examined.

INSPECTION PROCEDURE.

EXAMINATION OF INVOICES.

It may be of interest to outline the procedure followed at the port laboratories in the inspection of imported food and drug products. The work is closely identified with the work of the Customs Division

of the Treasury Department in the classification of goods for duty purposes. All shipments of goods, whether food or not, when presented for entry into this country, must be covered by an invoice setting forth the amount and value of the goods, signed by the American consul of the country from which the goods are shipped. When the goods arrive at the port of entry this consular invoice, together with the bill of lading, is presented to the customs department and from it is approximated the duty. The filing of these papers is called an "entry." The invoice, together with representative portions of the goods, is delivered to the appraiser of merchandise, who classifies the same and fixes the valuation thereof. The major part of the shipment, in the meantime, is released to the consignee under proper bond for its return if needed, a special form of bond being required for food products. It is while the invoice and merchandise are in the possession of the appraiser that the food and drug products are inspected by a representative of the Department of Agriculture.

The Secretary of the Treasury, at the request of the Secretary of Agriculture, has issued general instructions to the customs officials at the various ports of entry to afford the officers of the laboratories of the Department of Agriculture opportunity to inspect all shipments of food and drug products and to furnish such samples therefrom as may be requested.[1] No invoice covering food or drug products is permitted to be returned by a customs examiner until it has been inspected by a representative of the Department of Agriculture. The inspecting officer of the laboratory examines the invoices as received by the examiners having the various products in charge at intervals arranged according to local conditions. If the inspection of an invoice reveals no product from which a sample is desired or further examination necessary, the officer stamps the invoice "No sample desired by U. S. Dept. Agriculture." An invoice so stamped may be returned to the collector or passed to another examiner without further detention. If the inspection of an invoice reveals a product from which a sample is desired for analysis or further examination, the inspecting officer attaches to the invoice a "Sample requested" tag, on which is designated the particular item from which a sample is desired and the amount. It then becomes the duty of the examiner having the invoice in charge to procure the sample and forward the same at once to the laboratory, and also to notify the consignee of the goods that sample has been taken for analysis and that he shall hold the shipment intact until the analysis is completed and he shall receive further notice from the Department of Agriculture.

[1] Customs Regulations, 1908, page 422.

DETENTION.

It often develops that the inspecting officer is unable to determine from the information contained in the invoice whether or not a sample should be requested. In such cases he attaches a "detention" tag to the invoice, which retains the invoice in the possession of the examiner until the goods covered by the same are received and can be inspected by the officer to determine whether or not analytical examination is necessary. After completion of this inspection the invoice is stamped "No sample desired," or a "Sample requested" tag is attached, as is deemed necessary.

FLOOR INSPECTION.

All goods when opened on examining floors for classification by the examiners are inspected by the officer of the Department of Agriculture. Frequently the examination of labels, condition of product, etc., are all that is necessary and can be done as well on the examiner's floor as elsewhere. Frequent analysis of brands or lines of a manufacturer's products acquaints the examiner with the character of the product, and an inspection to determine the presence or absence of declaration of added materials may be all that is necessary. This form of inspection greatly facilitates the work, as it lessens the number of samples sent to the laboratory for analysis.

SAMPLING AND ANALYSIS.

Proper record of all invoices and products inspected and samples requested is made. Bulk goods, such as wines and oils in casks, coffee, spices, fruits, etc., which are not delivered to the appraisers' warehouse are inspected by means of samples secured by request upon proper examiner when, from the inspection of the invoice, the inspecting officer deems it necessary to have such samples.

All samples requested by the inspector are delivered by the examiner to the laboratory at the earliest moment possible. Because of the large volume of importations at the principal ports it is necessary to expedite all work in connection with the importations as much as possible to prevent congestion and delay of business. On receipt of the samples at the laboratory they are properly recorded and the required analysis and inspection made with the least possible delay consistent with thorough work.

RELEASE.

If, in the opinion of the chief of the laboratory, the results show that the sample does not violate any of the provisions of the food and drugs act, the importer is notified that no further action will be taken by the Department of Agriculture. This is termed a release

for the shipment, but it will be noted that no information is given the importer as to the result of the examination. Often shipments are released when there is an uncertainty as to whether or not the goods are in violation of the act and no question of injuriousness to health is involved. In such cases further analysis or investigation is made or samples are submitted to the Chief of the Bureau for his opinion, and when the question is finally decided the importer is notified for his information and guidance in regard to future importations.

ACTION ON GOODS DEEMED ADULTERATED OR MISBRANDED.

If, in the opinion of the chief of the laboratory, the results of analysis or inspection show a consignment to be in violation of the law, the collector of customs is requested to obtain actual possession of the same and the importer is notified of the nature of the findings and a date fixed at which time he may present in person or in writing any evidence to show why the shipment should not be excluded from entry into the United States for reason of the violation of the food and drugs act.

At the expiration of the time stated in the notice of hearing to the importer, the chief of the laboratory considers any evidence submitted, the results of the examination of the sample, information contained in invoice, and any other facts in his possession relating to the case, and decides whether or not the shipment is in violation of the act. If the decision is in accordance with precedent established by the decisions of the Board of Food and Drug Inspection and the Secretary of Agriculture, the chief of the laboratory communicates his decision direct to the collector of customs. If the decision involves an interpretation of a regulation or a subject not already passed upon by the Board of Food and Drug Inspection and the Secretary, and for which there is no precedent, the evidence and files of the case are forwarded to the Chief of the Bureau of Chemistry for consideration by the Board of Food and Drug Inspection and the Secretary, in which case the decision is reported to the Secretary of the Treasury, who instructs the collector of customs as to the disposition of the goods in question.

Products found to be in violation of the law are refused admission and required to be reshipped beyond the jurisdiction of the United States. If not reshipped within three months they are destroyed by the collector of customs. Often, where the violation consists of misbranding which may be corrected by label, permission is given by the Treasury Department to relabel the product under proper supervision in such a manner as to meet the requirements of the law, after which the goods are admitted. The privilege of relabeling is gen-

erally granted only in the first case of violation. Shipments, part of which may be in violation of the law for reason of damage or inferiority, may in some instances be separated under proper supervision and the sound portion allowed entry. The law as it refers to imports is enforced by simply refusing the admission of any products that are in violation of its provisions. The loss of the products, with the consequent loss of trade, expense of exportation, etc., has been found very effective in the enforcement of the law and is sufficient penalty in most instances.

IMPORTED FOODS AND DRUGS AND THEIR SOPHISTICATION.

VARIETY AND VALUE OF IMPORTATIONS.

Few persons not associated with the import trade appreciate the proportion of food and drug stuffs that is produced in foreign countries and shipped into the United States. It is the general opinion that the imported products are confined almost entirely to the luxuries, but the enumeration of a few of the principal products imported shows that this is not the fact, but that they form a considerable part of the supplies of every household. For instance, all of our coffee, cocoa, tea, and spices, such as pepper, allspice, ginger, nutmeg, mustard, etc., are imported; the greater portion of our sugar and olive oil is produced in foreign countries, and all of the orange and lemon oils. Great quantities of fresh fruits, as lemons, pineapples, bananas, etc., and of dried fruits, as figs and currants, are imported annually; also dried and salted fish and fish preserved in oil, such as sardines; and many of the canned vegetables, as tomatoes, artichokes, mushrooms, peas, beans, etc. There are also the various macaronis and pastes from Italy and France and the preserved fruits, marmalades, etc., of England and Germany, as numerous almost as those of domestic production.

Of the crude drugs only the most important ones will be mentioned, such as belladonna leaves and roots, cinchona, henbane, stramonium, digitalis, ipecac, coca, jalap, asafetida, nux vomica, sarsaparilla, senna, scammony, the various balsams, etc., to remind us that they are all of foreign production. The volume of these products annually shipped into the United States is enormous. During the fiscal year ending June 30, 1910, there were entered and passed at the port of New York 92,000 invoices covering shipments of food products having a total value of $84,920,207, while the value of the drug importations for the same length of time was $8,483,532. About 75 per cent of the food and drug products imported into the United States are entered at the port of New York.

EDIBLE OILS.

One of the principal classes of products that have been subjected to thorough inspection because of suspected adulteration is the edible oils. The principal edible oils imported are the olive, sesame, and peanut, the last two mentioned being of little importance in comparison with the first. The value of these products entered at the port of New York for the fiscal year ending June 30, 1910, was $3,500,000. When the inspection was first begun, several shipments of olive oil adulterated with peanut oil were found. Of late very few adulterants have been found in the olive oil as imported, the principal sophistication being its admixture with cotton-seed or sesame oil after it has reached this country.

MEATS AND MEAT PRODUCTS.

A class of products subject to very strict requirements for entry into the United States covers the meats and meat-food products. These consist principally of the smoked and canned meats, such as hams, bacon, sausage, etc., coming principally from England and Germany, and the fresh meats, as mutton and beef, from Canada, Australia, and South America. The total value of these entered at the port of New York during the past year was $534,361. To properly protect the health of the people of the United States, it is required that all imported meats and meat-food products shall be subject to the same inspection as the domestic products; therefore all shipments of these products must be accompanied by the certificate of an official veterinarian of the city or district in which the product was produced. This certificate must show that the animals were subject to competent ante-mortem and post-mortem examination and found free from disease and that the products have not been treated with chemical preservatives. The meat on arrival here is also subjected to inspection. The canned and smoked meats are examined for preservatives, artificial coloring matter, etc., and the fresh meats by the Bureau of Animal Industry for presence of diseased tissue. The principal adulterants detected have been boric acid for preservative purposes in bacon and sausages and artificial color in sausage.

FISH.

Of the many kinds of fish imported into this country the sardine has been most subject to adulteration and misrepresentation. The choicest sardines are caught off the coast of France and are cooked and packed in olive oil. Prior to the enactment of the inspection law it was a very common practice to label the fish packed in other countries, particularly Spain and Portugal, in the French language and

in such manner as to lead the purchaser to believe that he was obtaining a French product, when as a matter of fact it was not. Cotton-seed oil was also often substituted for olive oil, although the product was labeled as packed in olive oil. Other forms of adulteration consisted of the substitution of one kind of fish for another of greater value. It has also been found that some of the tinned fish, especially when packed with acid materials like tomato sauce, dissolve large quantities of tin, which may render the product injurious to health. This often results also from imperfect processing and canning. There was imported at the port of New York last year $4,319,167 worth of fish.

Another fish product that has been found to be adulterated often is caviar. The true caviar comes principally from Russia, though often shipped through German ports. Because of the limited supply and consequent high price of this product the roe of other fish is often substituted for that of the sturgeon, and the product, particularly the substituted one, is often preserved with a chemical preservative, the favorite apparently being salicylic acid.

COFFEE, COCOA, ETC.

The coffee imported into the United States exceeds in value that of any other one product. The total value of the coffee entered at the port of New York last year was $42,646,755. This product is practically all imported in the green state and therefore little adulteration is practiced. The principal inspection consists of an examination for damaged goods. "Black Jack," a trade name given to berries which because of damage have turned black, is prohibited entry.

Recently a few importations of a product designated as caffein-free coffee have come to the notice of the Department, all of which were found not to be free from caffein, but to have had about 75 or 80 per cent of the caffein removed.

SPICES AND CONDIMENTS.

The annual importation of spices and condiments at the port of New York is valued at about $3,000,000. Aside from paprika practically all of these are imported as whole spices. One of the most objectionable forms of adulteration practiced is the substitution of the exhausted spice, i. e., spice from which the essential oil has been removed, for the genuine. This practice is also difficult to combat for the reason that often such spices are shipped to this country labeled to show exactly what they are, though there can be no use for them after entry except as a diluent of the genuine article. The inspection work also reveals many instances of damaged, worm-eaten, and moldy spices, which are unfit for food purposes.

A product of quite recent introduction, which is now imported into this country in large amounts, is paprika, or sweet red pepper. The principal sophistication consists in grinding the product with oil, for the purpose of bringing out the red color, and thus pods, which were off in color, may be made to look of a better grade.

WINES AND LIQUORS.

As is well known, the wines and liquors are among the principal imports received in this country. The total value of the imports of these products at the port of New York for the last fiscal year was about $5,000,000, and their inspection constitutes one of the principal classes of import work. The misbranding consists principally in misrepresentations as to kind, quality, and place of production.

OTHER FOOD PRODUCTS.

Many other products might be mentioned, such as cheese, which is often made from milk from which all, or part, of the fat has been removed, which fact is not stated on the label, and the various preserved and canned fruits in which glucose is substituted in whole or in part for sugar, as the sweetening agent, etc.; but the products already mentioned indicate the general classes of food products brought to this country and subjected to inspection under the food and drugs act. The imported products are in general subject to the same forms of adulteration and misbranding as those of like kind of domestic production.

CRUDE DRUGS.

No class of imported products subject to inspection under the provisions of the food and drugs act have shown more marked improvement than the crude drugs. By the cooperative plan of inspection that has been established between the Department of Agriculture and the Treasury Department practically every shipment of these products is carefully inspected by the most efficient analysts and examiners. The following brief summary of the work of the New York laboratory for the fiscal year ending June 30, 1910, shows the kind and character of these products:

Belladonna leaves.—From about 60 shipments examined, less than 10 per cent have been deficient in assay. Of these, about one-half contained scopola leaves.

Belladonna root.—About 20 shipments were examined. Three of these contained poke root.

Asafetida.—This commodity, although there has been a considerable improvement, is still as a rule of poor quality. Of 45 shipments examined more than half did not come up to the U. S. Pharmacopœia standards.

CINCHONA.—Twenty-eight shipments were entered. All samples taken were above the U. S. Pharmacopœia standard.

BENZOIN.—Twenty-one shipments were entered. Almost all passed the 15 per cent insoluble standard. Several, however, were entered for "technical purposes only," and declared 25 per cent insoluble in alcohol.

JABORANDI.—With the exception of one sample, consisting of a false variety with alkaloid, all the jaborandi has been of excellent quality, assaying about 0.75 per cent.

COPAIBA.—One hundred and five shipments were entered; but 2 per cent contained foreign resins. Copaiba has improved to such an extent that the South American importations are practically pure. Five large shipments of African balsam were entered, consisting of about 200,000 pounds.

BALSAM PERU.—Sixty-two shipments were entered. The San Salvador and Colombian varieties are up to the U. S. Pharmacopœia standard.

SYNTHETIC PERU.—A very close imitation of the natural article has been offered, but the majority brought in for technical use only. Nine shipments of "Perugene" were entered in the same way.

HENBANE.—Of over thirty shipments entered, although many assay as high as 0.13 per cent, yet over 20 per cent are deficient in alkaloid, due to the excessive amount of sand mixed with the leaves.

STRAMONIUM.—Thirteen shipments were entered, all of which were of good quality.

QUINCE SEED.—Sixteen shipments were entered. Over 75 per cent were detained because of excessive foreign material, averaging 40 per cent.

JALAP.—Eighty-four shipments were entered. Of eleven samples analyzed, but one was deficient in resin.

Rhubarb, colchicum, chamomile, ipecac, coca, tolu, and guarana continue to be of excellent quality.

The extent of the work done at the twenty-one port laboratories in the inspection of imported foods and drugs alone is indicated by the following figures: During the last fiscal year 87,265 floor inspections were made and 8,217 samples were examined, of which 3,087 were found to be misbranded or adulterated. Of this number, 1,632 were reported illegal from the New York laboratory alone, 4,014 samples having been examined and 47,821 floor inspections made at that point.

NITROGEN-GATHERING PLANTS.

By Karl F. Kellerman,

Physiologist in Charge of Soil-Bacteriology and Water-Purification Investigations, Bureau of Plant Industry.

INTRODUCTION.

During the nineteenth century it was the pastime of scientists of a statistical turn of mind to calculate the probable date of the exhaustion of the world's supply of combined nitrogen. Earlier investigations had shown that crop plants could not use the nitrogen of the air and that they required for their growth large quantities of combined nitrogen, by which is meant nitrogen chemically united with other elements and thus forming ammonia, nitrates, etc. At this time it was known further that there were constantly in action many processes by which nitrogen could be released from its combined state and added to the supposedly useless supply of gaseous nitrogen in the atmosphere. No methods or processes for changing large quantities of nitrogen gas into forms available for plant food were known, and as it was recognized that animal life was absolutely dependent upon the vigorous continuation of plant life, one can appreciate the point of view of the alarmists, who believed that within a century the then existing supply of available combined nitrogen of the world would be exhausted and that all the living beings upon the earth would starve to death.

Fortunately for our peace of mind, the last two decades have witnessed so many advances in the knowledge of the natural processes for the maintenance of available combined nitrogen. as well as the discovery and development of practical artificial processes for fixing or combining with other elements the nitrogen of the air in forms suitable for use as fertilizers, that the question of the nitrogen supply for our agricultural land is no longer a bogey with which to scare the rising generation.

There is no doubt that as much combined nitrogen as is desirable can be constantly at the command of the farmer. The methods for maintaining the proper supply on the most economical basis, both at the present time and also considering the necessity of maintaining the fertility of the soil, are now the problems before the agricultural specialist. It is evident that as yet the knowledge in this field is incomplete, and it is believed that conclusions regarding the best

farm practice depend upon extending the scope of investigation to include not only the present agricultural crops, but also those plants which are generally considered useless or unimportant.

THE DIFFERENT GROUPS OF NITROGEN-GATHERING PLANTS.

Everyone is now more or less familiar with the ability of clovers, vetches, peas, and other members of the Leguminosæ that bear symbiotic bacterial nodules upon their roots to fix and utilize as food the nitrogen of the air. It is less generally known that certain other plants, entirely distinct from the Leguminosæ, also bear symbiotic bacterial root nodules and have nitrogen-gathering properties. As a matter of fact, the nitrogen-gathering property of all of these plants is due to the bacteria of their root nodules, or, to speak with scientific accuracy, the bacteria themselves are the nitrogen-gathering plants; from our present knowledge it seems safe to assume that a few species of bacteria and perhaps a few species of fungi and algæ are the only plants which have the power to fix atmospheric or gaseous nitrogen and make it available for plant food for the higher plants.

All of these microscopic plants are undoubtedly of economic importance, although it is probable that the three types which excel in nitrogen-fixing ability are the species of Clostridium, which fix nitrogen when given the proper food and deprived of oxygen; the species of Azotobacter, which fix nitrogen when supplied with oxygen as well as suitable food; and the bacteria of the symbiotic root nodules, which usually have a slight power of fixing nitrogen when supplied with oxygen and suitable food, but which reach their greatest effectiveness in manufacturing plant food from the nitrogen of the air when growing in the nodules on the roots of higher plants.

THE DIFFERENT TYPES OF ROOT NODULES.

It is usually considered that slightly different varieties of a single species of bacterium produce the nodules upon the different species of the Leguminosæ, respectively, and curiously enough it seems that additional varieties of the same species of bacterium perform similar functions for the nonleguminous plants which are supplied with nitrogen-fixing root nodules.

A comparison of the nitrogen-fixing nodules found upon the roots of different plants is interesting. It must be remembered that the nodules are in reality roots or rootlets which, because of the presence of the nitrogen-fixing bacteria within their cells, have developed abnormally to form the characteristic swollen root tubercles or nitrogen-gathering nodules instead of the ordinary form of root. It is to be expected, as each kind of plant has a slightly different root

development, that the root nodules will develop in a correspondingly typical manner. As a matter of fact the nitrogen-fixing root nodule of any kind of plant is almost as definite and characteristic for that plant as any morphological point of differentiation, such as the shape of the leaves or the arrangement of the leaves on the stem.

As shown in Plate VII, the different types of nodules found in the Leguminosæ vary from solitary, small, round forms to large, lobed, and clustered ones. The small spherical or club-shaped and somewhat lobed nodules shown in Plate VII, figures 1, 2, and 3, are characteristic of red clover (*Trifolium pratense* L.), white clover (*T. repens* L.), alsike clover (*T. hybridum* L.), and crimson clover (*T. incarnatum* L.). The typical form for these species is the lobed club shape. The simple club shape occurs on the smaller roots, and is the intermediate stage between the small spheres and the fully developed lobed club-shaped or fan-shaped forms, while the small spheres are merely young and undeveloped nodules. A somewhat similar nodule is found upon the roots of alfalfa (*Medicago sativa* L.), sweet clover (*Melilotus alba* Desv.), and bur clover (*Medicago arabica* (L.) All.), yet here, as shown in Plate VII, figure 4, the club forms are usually longer and more branched. Often the branched lobes resemble the outstretched fingers of a hand. A third variety of the club shape is found on the roots of garden peas (*Pisum sativum* L.), field peas (*P. arvense* L.), sweet peas (*Lathyrus odoratus* L.), hairy vetch (*Vicia hirsuta* S. F. Gray), common vetch (*V. sativa* L.), and one of the acacias (*Acacia dealbata* Link.). There is little chance, however, of confusing this type with the two types previously described; as shown in Plate VIII, figures 1 to 4, the branching of the lobes is less decided, and both the lobes and the entire nodules are larger and coarser in appearance.

The spherical nodule is perhaps the most common form. As shown in Plate IX, figures 1 to 7, it is found upon the roots of the cowpea (*Vigna unguiculata* (L.) Walp.), locust (*Robinia pseudacacia* L.), lima bean (*Phaseolus lunatus* L.), garden bean (*P. vulgaris* L.), mung bean (*P. radiatus* L.), peanut (*Arachis hypogœa* L.), and some of the acacias (*Acacia latifolia* Benth. and *A. esterhazia* Mackay). The nodules of the roots of the soy bean (*Glycine hispida* (Moench) Maxim.) are spherical, but they are usually distinguished from those of other plants by the slight parallel ridges or stripes upon the surface. The nodules of the yellow lupine (*Lupinus luteus* L.), though fundamentally of the spherical type, are usually found to be angular or irregular in outline. The bean-shaped nodule shown in Plate X, figures 1 to 5, is found upon the roots of the majority of the acacias (*Acacia armata* R. Br., *A. cyanophylla* Lindl., and *A. farnesiana* Willd.), the horse bean (*Vicia faba* L.), and the Tangier pea (*Lathyrus tingitanus* L.). Though the shape of the nodules is very nearly

the same, it should be noted that the surface of those upon the roots of the Tangier pea is peculiarly rough or uneven, and, in fact, in mature nodules may be almost spiny. The largest nodules known at the present time occur upon the roots of the velvet bean (*Stizolobium deeringianum* Bort). They are often found almost equal in size to a baseball, but as shown in Plate XI, figure 1, they are as characteristic in general appearance as they are remarkable for their size. The entire nodule is a compact cluster of thick branches, but the branches are so tightly pressed together, except near the periphery, that upon casual inspection one would suppose the nodules to be solid spheres studded with wartlike outgrowths.

The nodules described in the preceding paragraphs all occur upon the roots of different representatives of the Leguminosæ. Nitrogen-gathering nodules which occur upon the roots of plants not belonging to the Leguminosæ are shown in Plates XI to XIV. The nodule of the alder (*Alnus crispa* (Ait.) Pursh.), shown in Plate XI, figure 2, is very much the same in outline as the type found upon alfalfa, sweet clover, etc. It is always dark colored, however, and especially in the central and older portions is of a hard and woody texture. The same description would apply to the nodules of the New Jersey tea (*Ceanothus americanus* L.), shown in Plate XI, figure 3, as well as to those of the buffalo berry (*Lepargyrea canadensis* (L.) Greene) and silver berry (*Eleagnus argentea* Pursh.), shown in Plate XII, figures 1 and 2. The nodules of the mountain balm (*Ceanothus velutinus* Dougl.), shown in Plate XIII, figure 1, and of the sweet fern (*Comptonia peregrina* (L.) Coulter) are very similar to those found upon the vetches, sweet pea, garden pea, etc., though, as in the case of the alder, the texture of the nodule is much more woody than those upon the roots of the Leguminosæ.

The nodules of several representatives of the Cycadaceæ are shown in Plate XIII, figure 2, and in Plate XIV, figures 1 to 3. In view of the variation in type among other families and genera the similarity of the nodules of these plants is very striking. They are all fundamentally of the branched vetch or velvet-bean types, though considerable difference is shown in the shape and form of the branches. No one could mistake the nodule of *Encephalartos villosus* Lem., for instance, for that of *Cycas circinalis* L., yet any of these nodules would be recognized as belonging to the Cycadaceæ. Some investigators would question the inclusion in this category of the nodules of the Cycadaceæ. Nitrogen-fixing bacteria, apparently similar to the bacteria isolated from the Leguminosæ, have been isolated from nodules of various Cycadaceæ, as well as from the other nonlegumes shown in Plates XI, XII, and XIII, however, and it seems reasonable to consider different varieties of this organism the causal and essential agent of the symbiotic root nodules thus far

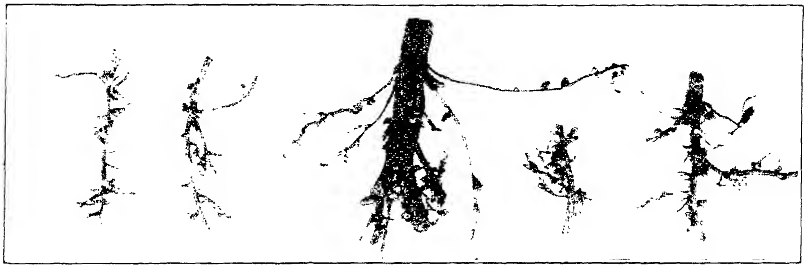


FIG. 1.—RED-CLOVER NODULES

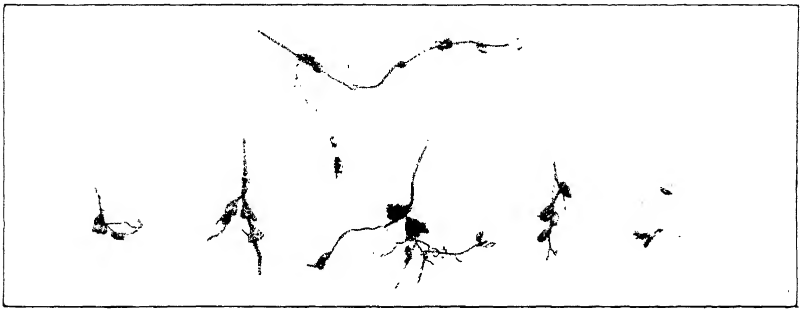


FIG. 2.—CRIMSON-CLOVER NODULES.

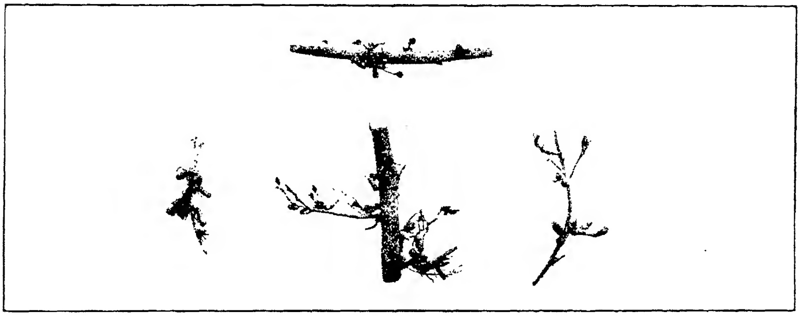


FIG. 3.—ALSIKE-CLOVER NODULES.

FIG. 4.—ALFALFA NODULES.

ROOT NODULES CAUSED BY NITROGEN-FIXING BACTERIA—I.

FIG. 1.—CANADA FIELD-PEA NODULES.

FIG. 2.—GARDEN-PEA NODULES.

FIG. 3.—VETCH NODULES.

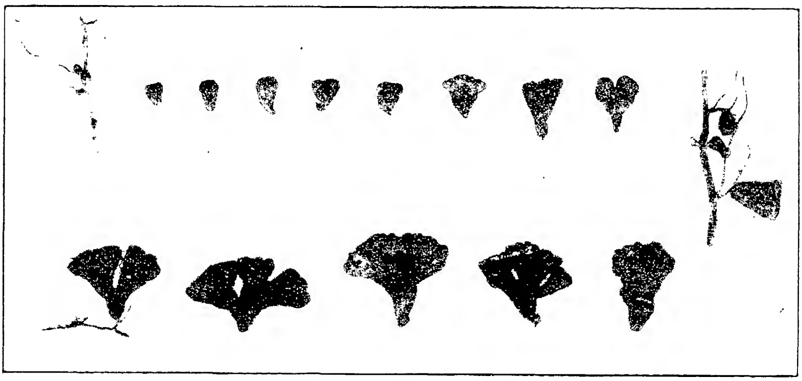


FIG. 4.—NODULES OF ACACIA DEALBATA.

ROOT NODULES CAUSED BY NITROGEN-FIXING BACTERIA—II.

FIG. 1.—NODULES OF ACACIA ESTERHAZIA

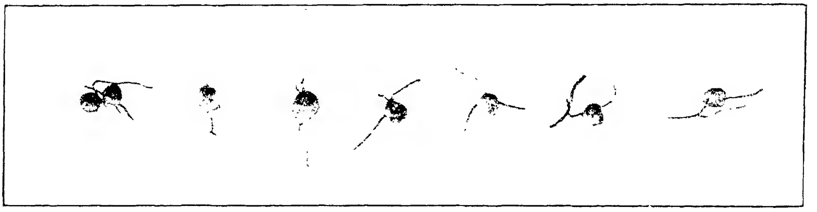


FIG. 2.—NODULES OF ACACIA LATIFOLIA.

FIG. 3.—COWPEA NODULES.

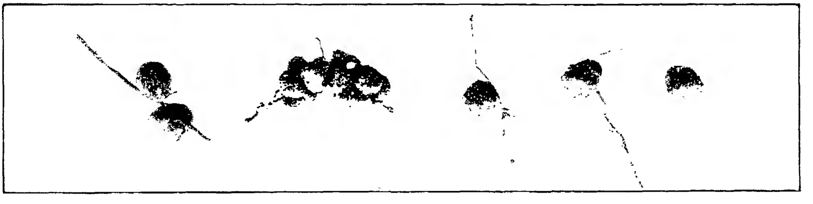


FIG. 4.—SOY-BEAN NODULES.

FIG. 5.—LIMA-BEAN NODULES.

FIG. 6.—LUPINE NODULES.

FIG. 7.—MUNG-BEAN NODULES.

ROOT NODULES CAUSED BY NITROGEN-FIXING BACTERIA—III.

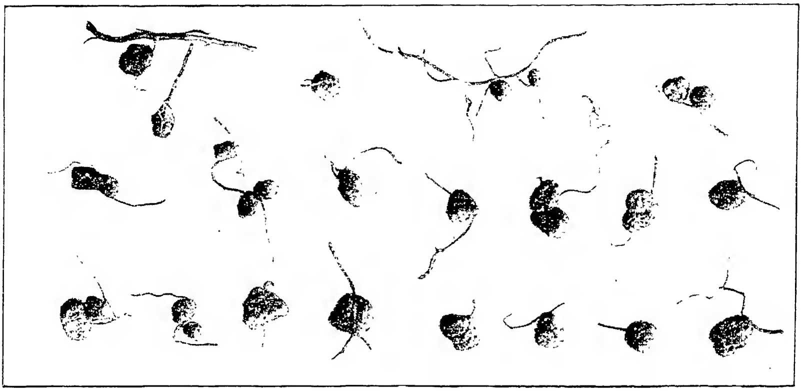


FIG. 1.—NODULES OF ACACIA ARMATA.

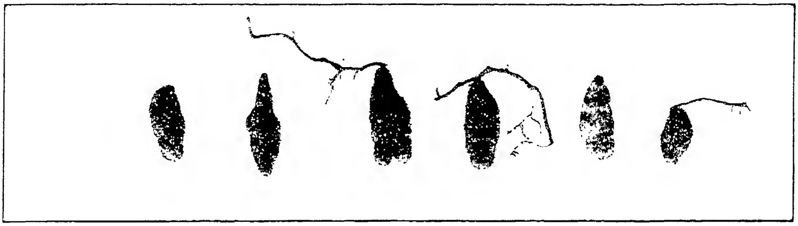


FIG. 2.—NODULES OF ACACIA CYANOPHYLLA.

FIG. 3.—NODULES OF ACACIA FARNESIA.

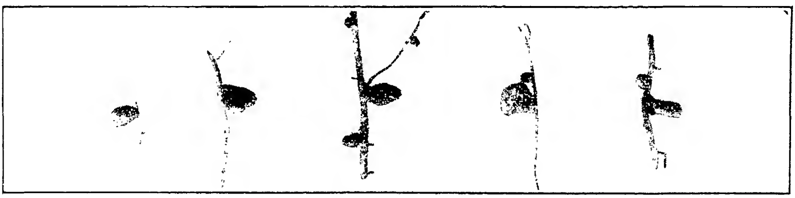


FIG. 4.—TANGIER-PEA NODULES.

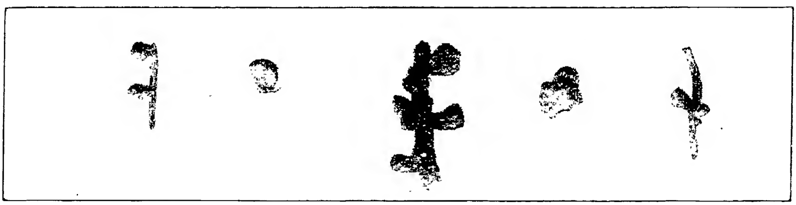


FIG. 5.—HORSE-BEAN NODULES.

ROOT NODULES CAUSED BY NITROGEN-FIXING BACTERIA—IV.

FIG. 1.—VELVET-BEAN NODULES.

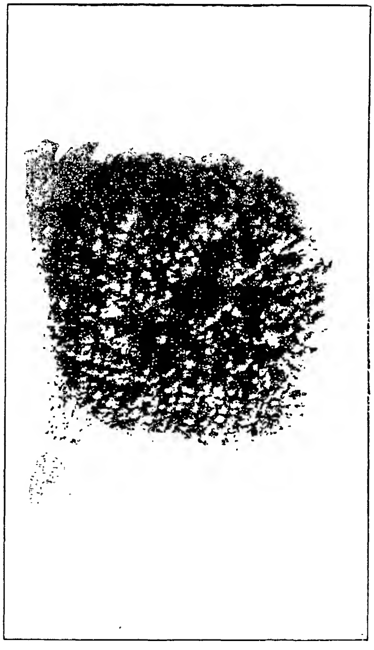


FIG. 2.—ALDER NODULES.

FIG. 3.—NEW JERSEY TEA NODULES.

ROOT NODULES CAUSED BY NITROGEN-FIXING BACTERIA—V.

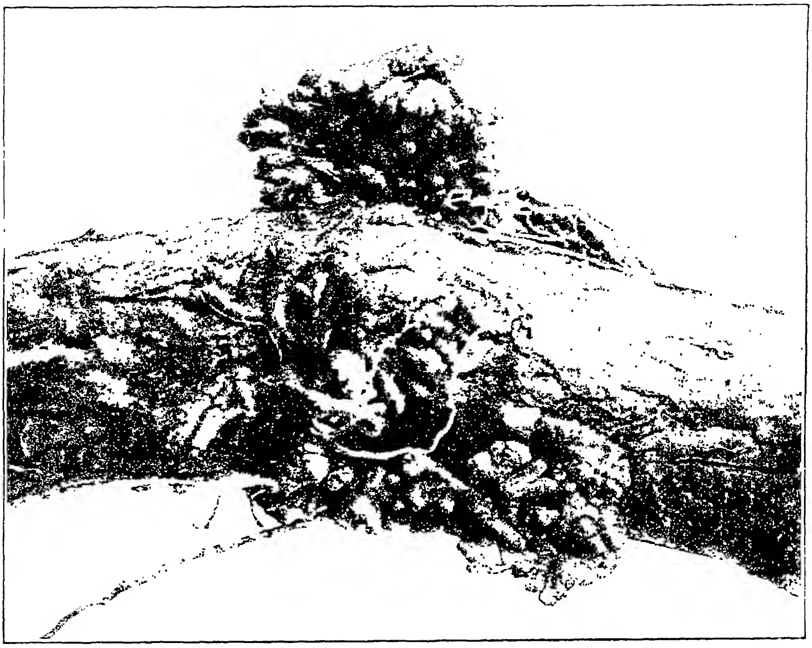


FIG. 1.—BUFFALO-BERRY NODULES.

FIG. 2.—SILVER-BERRY NODULES.

ROOT NODULES CAUSED BY NITROGEN-FIXING BACTERIA—VI.

FIG. 1.—MOUNTAIN-BALM NODULES.

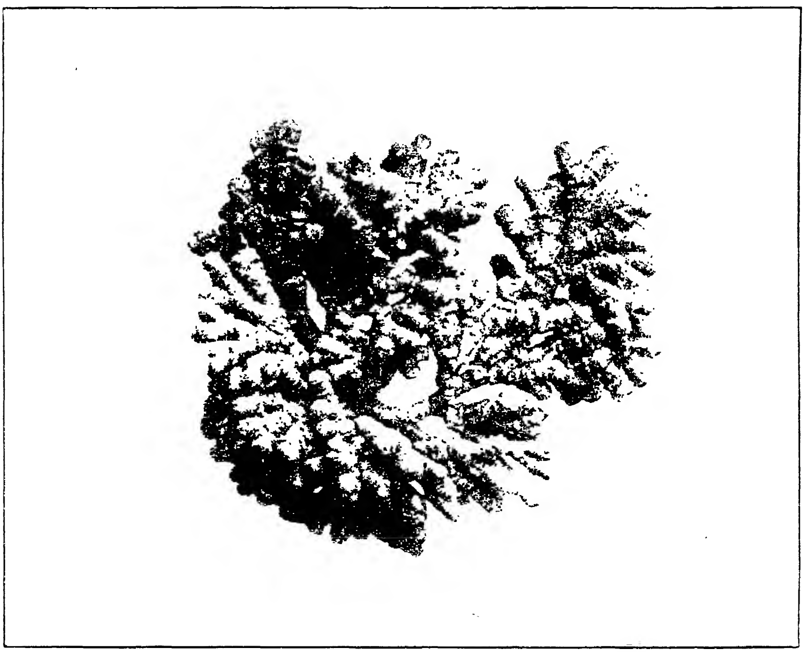


FIG. 2.—NODULES OF ENCEPHALARTOS VILLOSUS.

ROOT NODULES CAUSED BY NITROGEN-FIXING BACTERIA—VII.

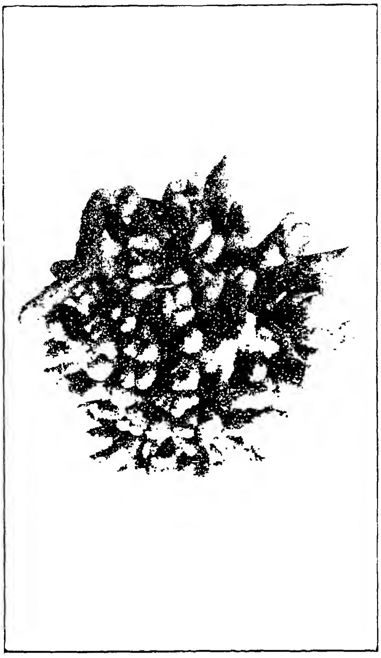


FIG. 1.—NODULES OF CYCAS CIRCINALIS.

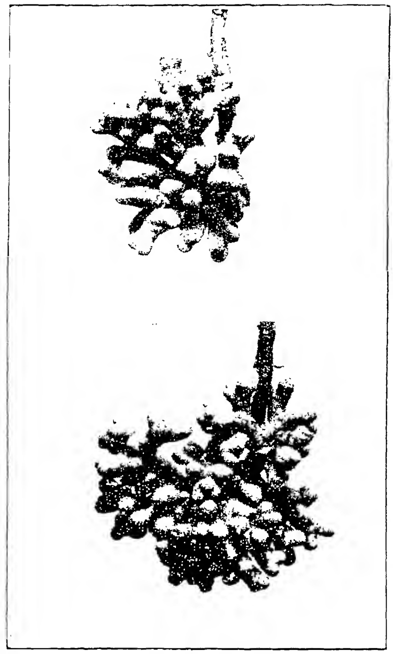


FIG. 2.—NODULES OF CYCAS SEEMANNI.

FIG. 3.—NODULES OF ENCEPHALARTOS HORRIDUS.

ROOT NODULES CAUSED BY NITROGEN-FIXING BACTERIA—VIII.

discovered. It is true that the Cycadaceæ have at present no agricultural significance. Whatever value they may have for present investigations will be comparative and will depend upon the possibility of learning the rôle which they played historically in the maintenance of the nitrogen supply.

THE RELATION OF NITROGEN-FIXING PLANTS TO THE POTENTIAL SUPPLY OF NITROGEN.

From the point of view of the modern agronomist it is necessary to consider the nitrogen supply of any field as divided into the quantities which are in available form for plant food and those not in immediately available form; it is further necessary to differentiate between the actual or existing supply of nitrogen and the probability of the replenishment or regeneration of the supply. Though it is not possible to draw hard and fast lines between the available, unavailable, actual, and potential nitrogen of the soil, these subdivisions are in reality fundamentally distinct. Nitrogen is available as plant food chiefly in the form of nitrate or ammonia, though for practical purposes organic nitrogenous material, such as manure, tankage, dried blood, etc., that in almost any kind of soil decomposes and forms ammonia, should be included. In many soils only a small and insufficient fraction of the total nitrogen actually present is available. This is a direct result of improper biological conditions in the soil and is usually, if not always, due indirectly to improper physical or chemical conditions, such as imperviousness to air and water, a tendency to become waterlogged or to bake, the lack of phosphates or of lime, etc. Successful farm practice presupposes the amelioration or prevention of such conditions, and as an obvious corollary demands that the soil be kept in such good tilth that the various groups of nitrifying bacteria may be actively engaged in changing the organic nitrogenous compounds into suitable food to be used by the various crops. This assimilation of nitrogen by the growing crop and the washing away of available plant food in the drainage water in regions of heavy rainfall are responsible for the annual removal of large quantities of nitrogen from cultivated fields. Under ordinary agricultural conditions, therefore, the potential nitrogen supply is of the greatest importance. In truck farming and, in fact, in many types of intensive cropping, the potential nitrogen supply may be largely artificial, depending upon the application of nitrogenous fertilizers. It then becomes a question of economics as well as a study of the maintenance of fertility to determine how much fertilizer to apply to secure the maximum net profit from a continuous series of crops.

In rotation systems which include clover, cowpeas, or other nitrogen-gathering crops either for hay or for green manure, the nitrogen supply, though naturally produced, is still largely under the control of the farmer and depends upon his ability to grow well-inoculated nitrogen-gathering crops at intervals which in the older agricultural regions have been empirically determined. The practical utilization, however, of the nitrogen-gathering plants which have no recognized value as crop plants up to the present time has been largely accidental. In spite of the fact that virgin land as well as worn-out land that has been allowed to "go wild" is generally rich in nitrogen, little, if any, attention has been given to the plants responsible for the nitrogen fixation. Nor is this a point of merely academic interest. Though but little time can be given to land which is not producing money crops, it is not improbable that only slight and occasional attention directed to encouraging the apparently valueless nitrogen-gathering plants would materially aid in maintaining the fertility of unused fields, as well as in forcing the worn-out or waste areas to reclaim themselves partially.

The alder, New Jersey tea, silver berry, buffalo berry, and sweet fern among the nonlegumes and numerous native and ordinarily unnoticed legumes belonging to the genera Kuhnistra, Psoralea, Genista, Baptisia, Melilotus, Amorpha, etc., occur throughout wide areas in the United States and with little trouble could be extended over much of the unused land. This is one of the simple and inexpensive but none the less valuable possibilities for the conservation and enhancement of the agricultural resources of the country. For in agriculture, even more than in other lines of science or business, it is necessary to plan constantly for future improvement and expansion.

CONCLUSIONS.

The plants which are of importance to us in the present epoch are the legumes which can be included in cropping systems; the legumes and root-noduled nonlegumes which can not be used in modern intensive agriculture, but upon which the potential fertility of land now unused may perhaps depend; and last, but not least, upon the types of microscopic plants of which Clostridium and Azotobacter are representatives. These bacteria are undoubtedly important both in supplying nitrogenous food in intensive systems of agriculture and in aiding the nitrogen-gathering legumes and nonlegumes to maintain or increase the fertility of virgin soils. The determining of the proper rôles for these various activities, the possibilities of the control and economic enhancement of the desirable functions, the recognition of the practical limits of biological factors in farm practice, as well as when and how to use nitrogenous fertilizers profitably—upon these things the economic maintenance of the agricultural nitrogen supply will depend.

SOME OF THE MORE IMPORTANT TICKS OF THE UNITED STATES.

By W. D. Hunter and F. C. Bishopp,

Of the Bureau of Entomology.

INTRODUCTION.

In recent years considerable attention has been attracted to the tick which transmits splenetic fever of cattle, known as the North American fever tick. The importance of this tick as the sole transmitter of the disease in nature has become common knowledge, at least in the South. As a matter of fact, this tick is of much greater importance than any other species occurring in the United States. Nevertheless there are other forms which should be considered. One species, for instance, transmits a serious disease of human beings which is spread over an extensive region and causes the loss of a considerable number of human lives each year. As in the case of the cattle disease, the human disease, known as Rocky Mountain spotted fever, is transmitted only through the attack of a tick, and the plan that is being followed in dealing with the cattle disease would apply in the case of the human disease; that is, the eradication of the tick would result in the eradication of the disease.

Although ticks are attracting more attention at the present time as transmitters of diseases than in other ways, they are of considerable importance as parasites of domestic animals. Their presence always results in irritation and the loss of blood. The consequence is that the infested animals frequently fail to make proper returns for the expense incurred in feeding, and in some instances the attack is so severe that death follows. (See Pl. XV, fig. 1.)

The object of the present paper is to point out some of the species of ticks occurring in the United States which are of importance either as transmitters of disease or otherwise. It will be noted that in several cases where diseases are not known to be transmitted at present, future investigation may possibly connect the ticks with certain maladies. It is thus very probable that increased knowledge of ticks will show a degree of importance which is not now realized.

All ticks occur in four stages, namely, egg, larva or seed tick, nymph, and adult. The ticks usually seen are adults, in which stage there are, of course, males and females. The females, however, increase greatly in size on account of the engorgement of blood; the males are consequently inconspicuous and generally overlooked, being

frequently found attached to the skin of the host directly beneath the females. After fertilization the females quickly become distended by the engorgement of a large amount of blood, which is utilized in the formation of eggs. When the body of the female becomes so distended that it will hold no more blood the tick drops to the ground.[1] Deposition of eggs begins in a short time. Depending upon the species, from 300 to as many as 11,265 eggs are deposited by a single female. Death follows after egg laying is completed. (See Pl. XVI, fig. 5.)

The seed ticks emerging from the eggs are provided with but three pairs of legs. The subsequent stages both have four pairs. The seed ticks remain in the immediate vicinity of the place where the eggs were deposited. There is a strong tendency to move upward on a blade of grass or similar support while awaiting a host animal. No food is taken by the seed ticks until they attach to the host.

Ticks have remarkable ability to exist for long periods without food, but as soon as a host comes within reach the seed ticks attach to the skin and immediately begin to extract blood and in a short time become distended. At this point some species drop to the ground for the purpose of molting and others remain upon the host, the general rule being to drop to the ground. To this there are two important exceptions, namely, the cattle fever tick, *Margaropus annulatus* Say, and the tropical horse tick, *Dermacentor nitens* Neumann, which do not drop for molting. In the case of the ticks which drop from the host as engorged larvæ the molt takes place in a short time. The stage reached after the molt is the nymph, in which stage the tick again awaits a host, often for a long time, and attaches, as in the larval stage, at the first opportunity and immediately fills itself with blood. It then detaches and another molt takes place, which marks the beginning of the adult stage. Again an opportunity is awaited to attach to a suitable host. When this occurs the males and females come together, fertilization takes place, and the engorgement of the females follows shortly, with the formation of eggs, thus beginning another cycle.

THE FOWL TICK (ARGAS MINIATUS KOCH).

The fowl tick is found in many localities in the warmer portions of the earth. Outside of the United States it has been recorded from Russia, Persia, North and South Africa, Australia, Mexico, and Brazil and other localities in South America. Notwithstanding this

[1]Among the species here discussed there are two exceptions to the rule that eggs of ticks are deposited on the ground. These are the spinose ear tick, which crawls upon posts or other supports, where oviposition takes place, and the chicken tick, which secretes itself in cracks in the vicinity of the perches and there deposits its eggs.

wide range over the globe, the species is of rather sharply restricted distribution in the United States. It is found very commonly in southern and western Texas, New Mexico, Arizona, and southern California. The range extends westward from a line drawn from Wichita Falls to Goliad, in Texas. This line corresponds almost exactly to the division between the humid and arid divisions of the Lower Austral zone, which is marked by the eastern limit of the area in which less than 30 inches of annual rainfall occur. There are reports of the occurrence of the species outside of the region indicated—for instance, from Florida—and one occurrence is known in Texas outside of the arid region. The numerous observations that have been made in Texas, however, show that the restricted range is distinctly marked. The occurrence of the species elsewhere is probably due to its shipment along with fowls or coops.

In the United States the fowl tick is probably the most serious pest of chickens in the regions where it occurs. In cases that have come to the attention of the writers, the raising of poultry has been abandoned on account of the death of the fowls as the result of the attack of this tick. Even where the infestation never becomes so heavy as to cause death, the irritation of the skin and the draining of blood interferes to such an extent with fattening and egg laying that the poultry industry has become unprofitable.

There is a possibility that this species may transmit a specific disease of fowls in this country. In Brazil, the Sudan, India, South Australia, and Transcaucasia a disease of fowls, known as spirochætosis, has been demonstrated to be transmitted by this tick. Up to this time no reliable evidence of the occurrence of this disease in the United States has come to hand.

The fowl tick may be identified readily by its appearance. The engorged adult is about one-third of an inch in length, of a bluish or almost blackish color. The conspicuous feature of the structure is the greatly flattened form and the roughened and pitted appearance of the skin. (See Pl. XVI, fig. 3.) The unengorged ticks are smaller, very flat, and have a brownish or yellowish appearance.

The eggs of this tick are deposited in cracks and openings of any kind in the buildings in which fowls are kept. The stage of the tick which hatches from the eggs has but six legs. It is ready to attach itself to fowls soon after hatching, and in from three to eight days it engorges and drops from the host. In about a week's time the larval tick sheds its skin and becomes a nymph, and is then ready to attach again to the host. This attachment is short, probably never occupying more than two hours. The tick drops again from the host, undergoes another molt, and appears in the second nymphal form. As in the preceding stage, the attachment to the fowl is very short. After

dropping again, another transformation takes place and the adult ticks emerge. After engorgement and mating, the deposition of eggs takes place. After each deposition the female attaches to the host and fills with blood, then secretes herself, and in due time deposits another mass of eggs, a process which may be repeated as many as six times. At least three separate engorgements and depositions of eggs seem to be normal.

The fowl tick is practically nocturnal in its habits. During the day and in the presence of artificial light it will secrete itself. Attachment to the host as well as dropping occurs normally during the night. While the later stages of the tick attach themselves for only a short time during the night, as has been stated, the first or larval stage remains attached for several days.

One of the most remarkable facts about the fowl tick is its longevity. The larvæ will live at least five months without food. The adults, in several instances, have been kept alive without nourishment for more than two years. It is also remarkable that the adult ticks are extremely resistant to insecticides. Applications of liquid preparations that will kill most insects seem to have but little effect upon them. These ticks are also very resistant to such poisonous gases as quickly kill most species of insects.

The considerations mentioned in the last paragraph indicate that it is not feasible to attempt to "starve out" the fowl tick by removing the birds from the houses, and that the application of insecticides is attended by many difficulties. It is fortunate, under these circumstances, that an economic and effective method of obtaining relief is available. This consists of providing perches for the fowls of such construction that the ticks are unable to reach them. This can easily be accomplished by suspending the perches from the ceiling by means of wires or iron rods. In this manner complete exemption from injury to the roosting fowls can be obtained. In the case of setting hens the same results may be obtained by providing nesting boxes on legs which are placed in cups or pans filled with crude oil.

THE SPINOSE EAR TICK (ORNITHODOROS MEGNINI DUGÈS).

The spinose ear tick has been recorded from a number of localities in the southwestern portion of the United States and in Mexico, as well as from Louisiana, California, Nevada, Idaho, Colorado, Nebraska, Kansas, Iowa, and Kentucky. Recent work which has been done toward obtaining accurate information regarding the distribution of ticks in the United States indicates that the occurrence outside of Texas, New Mexico, Arizona, southern California, southern Colorado, southern Utah, and Mexico are more or less accidental. In northern Louisiana a restricted infested region was found in 1907. In this

case there is a rather clear history of the introduction of the species with horses from western Texas.

The spinose ear tick is found only in the ears of animals infested by it. The species may be recognized primarily by this restriction in the place of attachment. The more common hosts are horses, cattle, dogs, cats, and man. Its appearance is unmistakable, the general color being yellowish brown or darker, the legs much paler. The engorged females measure about one-third of an inch in length and are irregularly oval in outline, the body being constricted just behind the middle. The surface of the nymphs is covered with small, sharp, spinelike bristles which aid it in maintaining its place in the ears of the host. (See Pl. XVI, fig. 4.)

In western Texas, New Mexico, and Arizona this species is found in the ears of many of the horses and cattle and not uncommonly causes the death of the animals. The irritation which it causes is increased by the fact that its wounds frequently attract the screw-worm fly, *Chrysomyia macellaria* Fab. If an animal is weakened from any cause and suffers from this combined attack it is likely to succumb.

A number of cases have been recorded in which this species has been taken from the ears of human beings. In such instances very great pain was caused, but as far as known no deaths have occurred.

Although this species is not known to be concerned in the transmission of disease, a closely allied form does transmit a disease of human beings in Africa. The same African species, *Ornithodoros moubata* (Murray), was recently found to be capable of transmitting spirochætosis in fowls.

There are certain peculiar features of the life history of this tick. When the nymphs are fully engorged they drop from the ears of the host and crawl upward on any convenient object. They then secrete themselves, molt, and begin deposition. This species never attaches to an animal in the adult stage.

The spinous ear tick, like the fowl tick, is able to exist for a long time without nourishment. Specimens have been kept alive in glass vials for a year and a half.

THE LONE STAR TICK (AMBLYOMMA AMERICANUM L.).

So far as known the lone star tick does not occur outside of North America and South America, but in these continents it has an extended range. It has been recorded from Labrador to Brazil. In the United States it has been taken from Maine to Michigan and from Florida to Texas. It appears to be rare or absent west of the Mississippi River, except in Louisiana and Texas, although it has been taken in Missouri, Arkansas, and Oklahoma. In Texas and Louisiana it is one of the most common ticks.

The lone star tick has been found on cattle, horses, human beings, dogs, goats, hogs, deer, squirrels, wolves, cats, and in the immature stages on certain birds. It appears to have a special predilection for goats. In the vicinity of Kerrville and Llano, Tex., where Angora goats are raised in great numbers, this tick is more common than in any locality known to the writers, far outnumbering all other ticks.

This tick and the Gulf coast tick are probably more frequently found attached to human beings than any species which occurs in the eastern and southern portions of the United States. Its long beak enables it to maintain a firm hold. Cases are on record in which severe results have followed such attachments. In these cases the injury seems to be merely mechanical or due to the ingress of bacteria through the punctures. Two investigators have conducted experiments to determine whether this species is capable of transmitting splenetic fever of cattle. They were unsuccessful in both cases.

The lone star tick may be identified by the presence of a bright metallic spot on the shield of the female. This distinct mark gives it the common name by which it is known. Fully engorged females sometimes measure over one-half inch in length. The general shape is oval and the color generally grayish yellow.

On account of its wide range and the number of animals it attacks, including man, this is one of the more important of the ticks. In localities where it becomes numerous the cattle, horses, goats, and sheep suffer severely from its attack. The long mouthparts, which penetrate deeply into the skin, seem to cause more irritation than is caused by the attack of the fever tick, *Margaropus annulatus*. The large amount of blood taken by this species is an additional factor in causing it to be of considerable importance to stock raisers.

This species is as susceptible as other species to oils and to the arsenical dip. To a certain extent it can be controlled by the same means which are used in controlling the fever species on cattle; at least this is the case in so far as dipping and greasing are concerned. The plans of relieving cattle of the fever tick and of freeing pastures by the starvation plan applied to the fever species are not equally effective against this one. The reason is that, unlike the fever species, it drops to the ground twice for the purpose of molting.

THE GULF COAST TICK (AMBLYOMMA MACULATUM KOCH).

The Gulf coast tick occurs in the United States in a restricted region along the Gulf coast, especially in Louisiana and Texas. It has been recorded from Tennessee, Virginia, and California on single occasions. The occurrence of the species in these States is probably due to its having been carried on some of its hosts from the region in which it occurs commonly. The range of the species extends through Mexico and far into South America.

FIG. 1.—COW DYING FROM GROSS INFESTATION BY THE NORTH AMERICAN FEVER TICK. (ORIGINAL.)

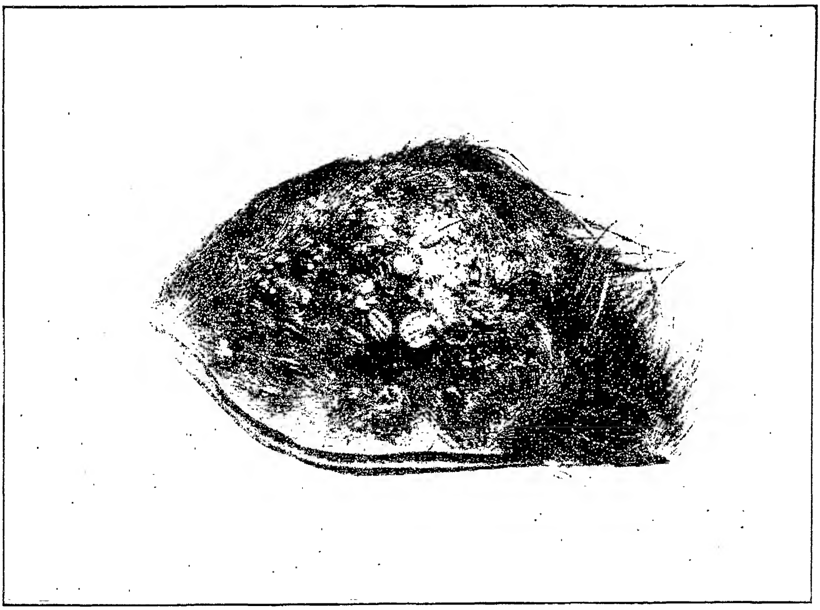
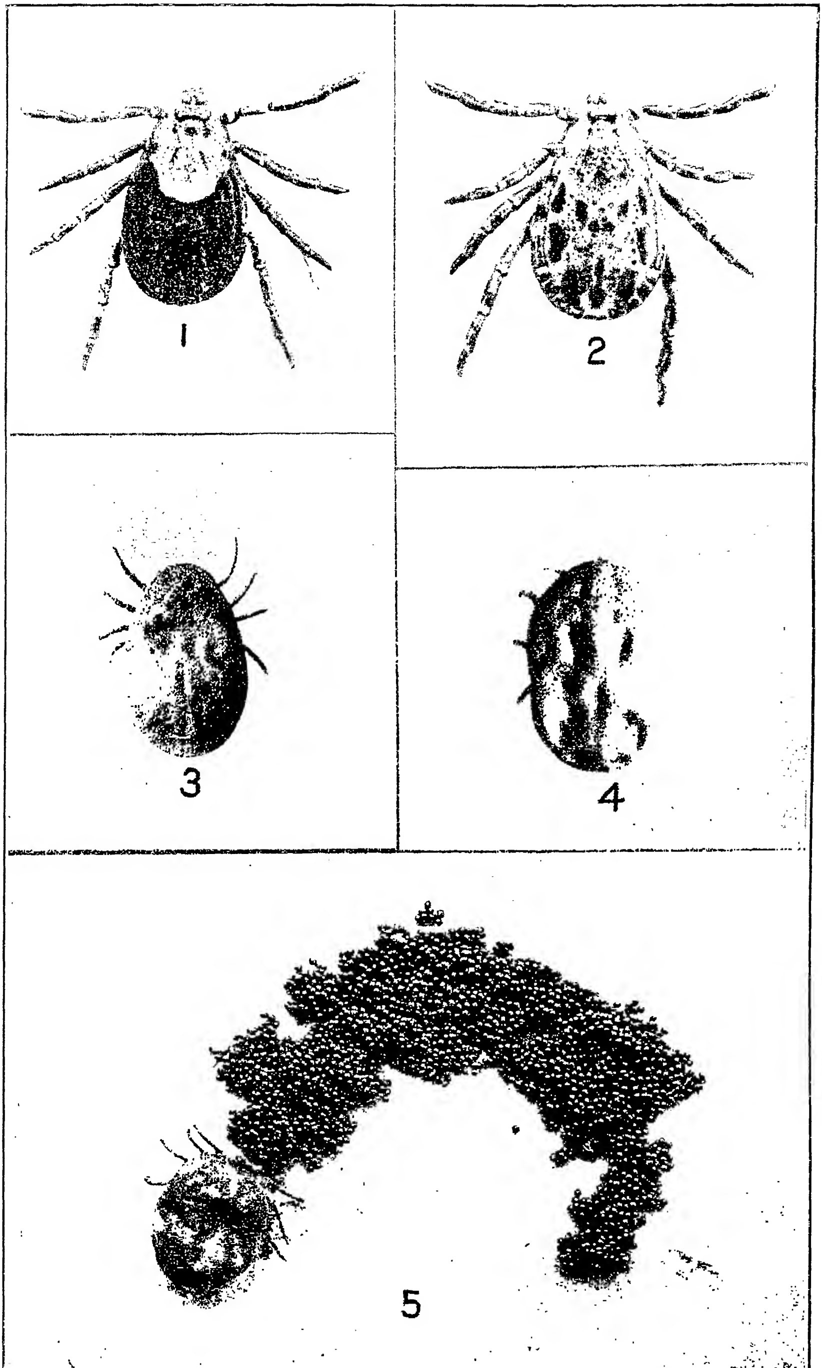


FIG. 2.—EAR OF CALF WITH CLUSTER OF GULF COAST TICKS. (ORIGINAL.)



SOME TICKS OF THE UNITED STATES.

[1.—Rocky Mountain spotted fever tick (*Dermacentor venustus*): Unengorged female. 2.—Same, male. 3.—Fowl tick (*Argas miniatus*): Partially engorged female. 4.—Spinose ear tick (*Ornithodoros megnini*): Engorged nymph. 5.—North American fever tick (*Margaropus annulatus*): Female depositing eggs. All enlarged. (Original.)]

The Gulf coast tick is found more commonly on the dog than on any other host, although in its range in this country it is frequently found upon cattle, as well as upon human beings. It is probably more inclined to attack human beings than any species found in the United States, except possibly the Rocky Mountain spotted-fever tick.

In size and general appearance this tick resembles the lone star tick, but lacks the metallic spot which very readily distinguishes the female of the lone star tick from all other species. The light marking of the shield forms an irregular lyre-like pattern.

In attacks upon various hosts it has been noted that this species is inclined to form clusters consisting of a half dozen or more individuals. The long mouthparts give it a firm hold upon the host, naturally causing considerable irritation. The clustering thus leads to an amount of local irritation which frequently affects the host severely. (See Pl. XV, fig. 2.) Up to the present time this species has not been found to transmit any disease.

The life history of the Gulf-coast tick is very similar to that of the lone-star species, which has been described. The only control measures that can be suggested are the use of oils or grease applied locally or the dipping in any of several well-known "tickicides."

THE ROCKY MOUNTAIN SPOTTED-FEVER TICK (DERMACENTOR VENUSTUS BANKS).

The Rocky Mountain spotted-fever tick is restricted in range to the western portion of the United States. Recent work by the Bureau of Entomology has shown that it occurs from Wyoming to Washington State, and from New Mexico to California. It is thus essentially a species of the Rocky Mountain region. It is not to be found, however, equally numerous in all portions of that section. The greatest abundance seems to be in Montana, Idaho, and Wyoming. South of Colorado and Utah it is very uncommon. The relative abundance of this species in different States is probably indicated by the number of lots of specimens which were received at the Dallas laboratory during the season of 1910, 85 lots having been received from Montana, 84 from Idaho, 72 from Wyoming, 51 from Washington, 29 from Colorado, 25 each from Oregon and Nevada, and 9 from California. The range of the species also extends into Canada and possibly Alaska, but its occurrence outside of the North American Continent is unknown.

This tick, in certain ways, is not especially restricted as regards hosts. The immature stages are to be found on a large number of rodents, but the adult stage occurs only very exceptionally on these animals. Adults have been taken commonly from only horses, cattle, deer, and mountain goats, in addition to man.

The existence of a number of closely allied species renders it impracticable to give a description of this form which would enable the general observer to identify it. (See Pl. XVI, figs. 1, 2.)

Although of some little importance in the adult stage as a parasite of domestic animals, the injury to man by transmission of Rocky Mountain spotted fever overshadows the importance of this species in all other respects. It is one of the two ticks which are known to transmit diseases of human beings. The other case is an African tick, *Ornithodoros moubata*, which transmits African relapsing fever. The history of the various steps in the demonstration of the connection between this tick and spotted fever is of great interest. The disease itself was not recognized as a distinct malady until a comparatively few years ago. In 1902 Doctors Wilson and Chowning first placed on record the hypothesis that the disease was transmitted through the agency of a tick. In 1906 Dr. H. T. Ricketts undertook the study of the question. As a result of most carefully planned and praiseworthy investigation under many difficulties, Doctor Ricketts demonstrated that this species transmits the disease in nature. The control and eradication of spotted fever has therefore become essentially a matter of the control of the tick, exactly as the control of yellow fever or malaria depends upon the eradication of certain species of mosquitoes.

The importance of this tick may best be considered in connection with the disease which it transmits. Although spotted fever occurs throughout the Rocky Mountain region, the death rate is high in but one locality. Ordinarily the death rate ranges in the neighborhood of 5 per cent. In the Bitterroot Valley, in Montana, however, there exists a type of the disease in which the death rate is much higher; it averaged 70 per cent in 114 cases which were collated in 1902 by Doctors Wilson, Chowning, and Ashburn. It is estimated conservatively that since 1885 at least 400 cases of spotted fever have occurred in the Bitterroot Valley, the percentage of deaths showing that during this period the fever has caused the loss of 280 human lives. The deaths, outside of the Bitterroot Valley, due to the less virulent form of the disease, probably increase the total mortality during the last twenty years to 1,000. It will thus be seen that the tick is of considerable importance in a large portion of the United States.

In addition to the direct loss of lives, a great indirect injury has been done by interfering with the development of large areas of land. Moreover, there is a possibility that this tick may become of even much greater importance. As far as can be seen there is no reason why the virulent form of the disease occurring in the Bitterroot Valley could not be transported to other regions. If a person or animal harboring the organism of the disease should move from

the Bitterroot Valley to some other State where the fever tick occurs, opportunity would be given for the introduction of the virulent strain. This consideration emphasizes the great practical importance of attempting the eradication of the tick in the Bitterroot Valley.

As has been indicated, this tick occurs in the immature stages on a large number of small mammals and in the adult stage only on man or a few of the larger animals. It is found in numbers in the adult stage only during a limited season. It is first noticed on domestic animals in very early spring. The season normally begins about the 1st of March and extends until about the 1st of June, after which the tick is not noticed until the following season. This seasonal abundance of ticks corresponds to the period to which cases of spotted fever are restricted.

Like the majority of ticks, the Rocky Mountain spotted fever species engorges and drops from the host for both molts. It is thus radically different in habits from the species which transmits splenetic fever of cattle and its control is correspondingly more difficult.

Recent investigations in Montana by the Bureau of Entomology, in cooperation with the Montana Agricultural College, have indicated certain apparently feasible means for reducing the numbers of this species, or the possibility of eradicating it altogether. The matter will be dealt with fully in a contemplated publication.

THE PACIFIC COAST TICK (DERMACENTOR OCCIDENTALIS NEUMANN).

So far as now known the Pacific coast tick is limited in its distribution to western and central California and western Oregon. It is probably also to be found in Lower California and northwestern Mexico. It is the most common tick in the Pacific coast region, where it is usually called the wood tick. Cattle, deer, horses, dogs, and man are the more common hosts of the adults. The immature stages undoubtedly attach to various small mammals. On account of the fact that this tick occurs throughout practically the entire season in certain regions, it is of some importance as a pest of live stock. It is said to be most numerous during the rainy season, and at that time is frequently the source of much annoyance to man.

This species resembles quite closely the Rocky Mountain spotted fever tick, but by the trained eye is readily distinguished from that species. It is much the same in color as the fever-transmitting species, but the white markings are interrupted by numerous red points, which give it a characteristic appearance. The engorged females are somewhat smaller than other members of this group of ticks, seldom attaining a length of more than one-third of an inch.

As has been stated, this species frequently attacks man, but no disease is known to be carried by it. Until recently this tick has been confused with the tick *Dermacentor venustus* Banks, which transmits Rocky Mountain spotted fever. The name *Dermacentor occidentalis* erroneously appears in medical literature in connection with that disease.

On account of the fact that this species drops from the host twice during its development in order to molt, it is doubtful if any method other than the use of "tickicides" can be successfully used in keeping it under control.

THE AMERICAN DOG OR WOOD TICK (DERMACENTOR VARIABILIS SAY).

The American dog tick is the most common species occurring east of the Mississippi River. Its range extends from Labrador to Florida; although it occurs in Texas, it is uncommon there. Throughout the central and Rocky Mountain regions it appears to be rare. Recently, however, an area of considerable size in California and Oregon in which this species occurs commonly has come to attention. It is surmised that the species was introduced there by artificial means.

The immature stages of this tick are found upon various small mammals. The dog appears to be the most important host for the adult stage, although in this stage the tick occurs upon various wild animals as well as cattle and man. Although it has a strong tendency to attach in the ears of the host it does not attach far down in the ears, as does the spinose ear tick.

This tick, when engorged, is of a bluish color. When fully engorged the female usually measures nearly one-half inch in length. The shield is reddish brown, marked with white. The marking is more or less variable, but generally maintains a pattern which enables the species to be recognized.

Although of widespread occurrence in the United States, this species is of comparatively little importance. The dog is the only host which ever suffers any serious consequences. The species is rather well known on account of its attaching to human beings, but so far as the records show no special consequences have ever followed its attack. The removal of the ticks from any host is an easy matter.

THE RABBIT TICK (HÆMAPHYSALIS LEPORIS-PALUSTRIS PACKARD).

The rabbit tick is one of our most widely distributed species, being very commonly found on rabbits throughout the United States and Mexico. It has also been reported from South America. In the extreme southwestern portion of the United States and portions of California, however, the common tick found on rabbits is another species.

This rabbit tick has been recorded from horses in one instance. With this one exception the rabbit is the only mammal upon which the adults of the species have been found. The larvæ and nymphs are found very commonly upon ground-inhabiting birds, such as quails and larks.

The engorged ticks are dark blue-gray to almost black in color. They frequently measure one-third of an inch in length when fully engorged. No white markings appear on the shields of either the male or female. In all stages the mouthparts are extended on each side so as to form prominent angles. This character can usually be seen by the naked eye and is a reliable means of distinguishing the species from others found on rabbits.

These ticks usually attach about the rabbits' ears, or on other portions of the head. The engorged larvæ and nymphs drop from the host in order to molt.

On account of the fact that this tick is seldom found on other hosts than the rabbit, it is of little economic importance. In some cases it becomes so numerous upon rabbits and weakens them to such an extent that they are easily captured by any animal that preys upon them. The Bureau of Entomology has a record of 1,033 ticks of this species having been taken from two rabbits in western Montana.

An allied species, *Hæmaphysalis chordeilis* Packard, has recently been reported as causing the death of young turkeys in Vermont. Another related species transmits a disease of the dog, known as malignant jaundice, in certain parts of South Africa.

THE NORTH AMERICAN FEVER TICK (MARGAROPUS ANNULATUS SAY).

The well-known transmitter of splenetic or Texas fever of cattle, *Margaropus annulatus* Say, in importance far exceeds any of the other ticks found in this country. It has received attention in various departmental publications and will consequently be given but brief notice in this paper. It is found throughout the Southern States. The original northern limit of its range in the eastern part of the country corresponded rather closely to Mason and Dixon's line. The work of eradication which has been undertaken recently has reduced the infested area considerably. Closely allied forms occur in other parts of the world, where they transmit diseases of cattle which are very similar, if not identical, with the splenetic fever which occurs in this country.

This tick causes a direct loss of at least $40,000,000 a year in the United States; indirectly the damage is much greater. Although primarily a factor connected with cattle raising, the importance of this species extends far beyond that industry. It practically inhibits the proper utilization of live stock and thus prevents a rational system of agriculture. In this manner the whole structure of the

South is affected and its development held back. A better system of agriculture and rapid development are sure to follow the eradication of the tick.

There are two peculiar features of the life history of this tick: It is practically restricted to cattle as a host, and it does not fall to the ground for the purpose of molting. These two peculiarities render the control of the fever tick a comparatively simple matter. Its failure to exist on other hosts renders it practical to free areas of infestation in a comparatively short time by the simple device of keeping the cattle out. Likewise the dipping or greasing of cattle is a certain and economical method. Both of these means are being practiced by the Bureau of Animal Industry of the Department of Agriculture, which has undertaken extensive work which will ultimately relieve the South of a most important obstacle to development.

THE BROWN DOG TICK (RHIPICEPHALUS SANGUINEUS LATREILLE).

In the United States the brown dog tick occurs numerously only in southern Texas, although there are records from a few other places. Outside of the United States it has a wide range. It occurs commonly in Mexico, Central America, the West Indies, India, the Mediterranean regions, South Africa, and elsewhere. In tropical and subtropical regions throughout the world it appears to be the most common tick of the dog, but sometimes occurs on other hosts, the horse having been recorded. Essentially, however, at least in the United States, it is a parasite of the dog.

The brown dog tick may be known by the reddish-brown color. This is not relieved by lighter colored markings, as is the case with other species of ticks found infesting dogs in this country. Unlike the common dog tick in the eastern portion of the United States, this species is found on any part of the host.

The allies of the brown dog tick which occur in South Africa are among the most important disease-bearing ticks that are known. On account of its close relation to the pathogenic forms, our species is of considerable interest. At present, as a mere parasite of the dog, it is of some importance in southwestern Texas.

In India the brown dog tick has been found to be a transmitter of a protozoan disease of the dog. Up to this time there is no authentic evidence of the occurrence of this disease in the United States. If once introduced, however, there appears to be no reason why it should not spread in the region in which this tick is commonly found. A number of related species which do not occur in North America are concerned in the transmission of several important diseases of live stock in other parts of the world.

Control of this species can be obtained by the systematic use of oils or grease.

THE ERADICATION OF CATTLE TUBERCULOSIS IN THE DISTRICT OF COLUMBIA.

By R. W. Hickman,

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The eradication of tuberculosis from the dairy herds of the country seems, at the present time, to be occupying a prominent place in the minds and thoughts of breeders and of the general public. Owing to this increasing interest there is a growing demand on the part of the breeder for breeding stock free from tuberculosis and on the part of the public for a sanitary milk supply. As a result it is observed that dairymen and milk venders, either because of the pressure which is being brought to bear on them through the workings of competition, or for economic reasons, are in many sections combining in their efforts to free their dairy herds from tubercular infection, and seem to be more generally falling into line in the great movement for the eradication of cattle tuberculosis.

Thirty-five States and Territories, including Hawaii, now have, as a result of direct legislation or by proclamation of the governor, promulgated orders requiring the tuberculin testing of cattle as a prerequisite to their entrance. It is therefore not surprising that the work in connection with the eradication of cattle tuberculosis in the District of Columbia by the Bureau of Animal Industry of the Department of Agriculture, in cooperation with the District government through its health officer, has attracted widespread attention and unusual interest. In view of this interest and of the many inquiries received for explicit information regarding the work and the measures applied in its conduct, a comprehensive though necessarily concise account of its prosecution is here presented.

The order of the Commissioners of the District of Columbia and regulations under which this work has been carried on are given at the end of this article. This order became effective when signed by the Secretary of Agriculture, November 27, 1909. The systematic testing of the cattle of the District under its provisions was begun two days later, and it required about four months to cover the entire territory, 1,701 head in all being tested. The work could probably have been accomplished with the working force utilized in considerably less time had it not been for the large number of premises upon which only one or two cows were kept.

A relatively insignificant opposition was experienced, the owners generally exhibiting a favorable attitude and a disposition to aid the work. They realized the advantages that would ensue when their

cows would no longer be exposed to the infection of bovine tuberculosis through diseased animals and infected premises. It may be stated, however, that the reimbursement provisions of the order constituted a feature of no small importance in securing the acquiescence and cooperation of owners in the eradication movement.

Six Bureau veterinarians were assigned to the testing work, four of whom were continued throughout the four months, one during three months, and one was withdrawn within two weeks of the beginning to direct and supervise the cleaning and disinfection of premises following the slaughter of reactors.

The testing of the cattle was begun in the southeast corner of the District of Columbia, at which point a canvass was started, covering a designated territory, with a view to locating the owner of every bovine animal in such territory. Thus canvasses were made of successive sections of the District until the whole had been covered and the original testing completed, which occupied the period from November 29, 1909, to April 2, 1910.

Meanwhile all cattle entering the District of Columbia from Maryland, Virginia, or other States, except beef cattle consigned in cars for slaughter at establishments under Federal meat inspection, were identified, tagged, and handled in accordance with the order of the Commissioners. As a result of thus following up all animals tagged, it was found that no attempt was made to retain calves and castrated cattle brought in for slaughter; therefore an amendment was issued March 5, 1910, removing all restrictions concerning the entrance of these two classes of slaughter stock.

Immediately after the finding of reactors to the tuberculin test a satisfactory appraisement was made, and the cattle were sold to the butcher submitting the highest bid, to be slaughtered subject to official post-mortem inspection.

Promptly following the removal of reacting cattle, the premises that had been occupied by them were thoroughly cleaned and disinfected under the supervision of a Bureau employee, a solution of bichlorid of mercury in water, 1 to 800, being used for this purpose and applied in the form of a spray by means of a strong force pump.

Of the total number of cattle in the District of Columbia entering into the original test (1,701 head), 1,380 were apparently free from tuberculosis, having passed a satisfactory tuberculin test, while 321 reacted and were slaughtered, and 305 of these were appraised and the owners indemnified. The remaining 16 animals were from Government-owned herds, for which no reimbursement was claimed.

In the post-mortem inspections of these carcasses, the correctness of the tuberculin reactions was verified in 98.36 per cent of the reactors, leaving only 1.64 per cent in which no tuberculous lesions were found. As an examination was not made of the deep-seated lym-

phatic glands and the interior of the joints, even this small percentage can not be positively classed as errors in diagnosis.

The following table gives a summary of the work:

Summary of cooperative tuberculosis investigations for the suppression and prevention of tuberculosis in cattle in the District of Columbia from November 29, 1909, to April 2, 1910.

Total number of premises upon which tests were applied	556
Number of infected premises	102
Percentage of premises infected	18.35
Total number of cattle tested	1,701
Number free of tuberculosis	1,380
Number of reactors	319
Number of suspects, which later reacted	2
Percentage of reactors	18.87
Number of cattle for which owners were reimbursed, on 98 premises (reimbursement not claimed for 16 cattle, on 4 premises, Government herds)	305
Total appraised value of 305 cattle	$13,851.10
Average appraised value per cow	$45.41
Proceeds of sale of 305 cows to butchers	$5,757.08
Average sale price to butchers	$18.88
Total reimbursement from available funds of Department	$4,264.02
Average reimbursement per cow	$13.97
Total loss to owners on account of diseased conditions found in animals	$3,830.00
Average loss to owners per cow	$12.56
Percentage of total appraised value paid by butchers	41.56
Percentage of total appraised value by reimbursement	30.78
Percentage of loss to owners by reductions from appraisement values on account of disease conditions found on post-mortems	27.66
Number of cattle upon which sale price to butcher equaled or exceeded reimbursement	11
Number of carcasses exhibiting lesions of tuberculosis and passed for food purposes	234
Number of carcasses exhibiting lesions of tuberculosis and condemned	66
Number of carcasses failing to exhibit lesions of tuberculosis	5
Percentage of carcasses passed for food	76.72
Percentage of carcasses condemned	21.64
Percentage of carcasses failing to exhibit lesions of tuberculosis	1.64

Summary of expenses of testing:		
Salaries	$3,275.00	
Travel	615.48	
Hypodermic syringes, clinical thermometers, tags, and incidentals	95.01	
Total expenses of testing and tagging		$3,985.49
Cost to Bureau for reimbursement of owners		4,264.02
Salaries and traveling expenses in connection with disinfection of premises		1,020.54
Total expense to Bureau		9,270.05

The slaughter of cattle which reacted to the tuberculin test naturally created an increased demand for dairy cows within the District, and cattle dealers proceeded to purchase cattle to supply this demand. Such cattle were mostly allowed to enter on permit, after identification, and were tuberculin-tested on the premises of the dealer, who, in case of reactors, bore the loss without reimbursement. Cattle were permitted entry into the District when accompanied by a satisfactory certificate of tuberculin test by an official veterinarian of the State from which they originated, and some were imported in this manner, while in several instances Bureau inspectors applied the tests at nearby points in neighboring States prior to entrance. Thus dairymen within the District were enabled with very little delay to replace their tuberculous animals with cattle known to be free from the disease.

In order that tuberculosis eradication work in any given locality may be effective, a definite plan of operations is imperative; therefore, in accordance with a previously arranged program, it was the intention to retest animals once a year on premises shown to be free from tuberculosis on the original test, but to apply retests semiannually, followed by thorough disinfection, on any premises upon which the infection should seem to persist. Accordingly the work of retesting was begun on June 1, six months from the time of inaugurating the work, on all premises which has shown infection on the original test.

The work in the District of Columbia was undertaken in the belief that a demonstration of the practicability of eradicating cattle tuberculosis from a given area would serve as an incentive for other communities, municipalities, or States to take up similar work. The working methods herein outlined successfully accomplished the desired results, and may serve as an encouragement to similar undertakings in other sections where a disposition to take up the work has been expressed, but where difficulty has been met in the formulation of proper plans and in securing the means for their execution. In connection with the latter, it should be noted that an important point exists in the degree to which the salvage reduces the expense of indemnifying the owners for the loss of their cattle.

While the tuberculin test is a wonderfully accurate agent in the hands of the qualified man for the diagnosis of tuberculosis, there is no uniform characteristic in the tuberculin reaction that will admit of a determination of the extent or the stage of the disease in the tuberculous subject; consequently there are of necessity animals condemned and slaughtered because of having typically reacted to the test which are not at the time of slaughter capable of transmitting infection. This fact is frequently pointed out as one of the chief

objections to the eradication of tuberculosis by this means of diagnosis. On the other hand, as shown by Dr. E. C. Schroeder, superintendent of the Bureau of Animal Industry Experiment Station, and others, neither is it possible by any known means to determine how soon an apparently healthy and profitable cow which has reacted to the tuberculin test will become a center of infection and a source of danger to other animals with which she is associated. (See Bureau of Animal Industry Circular 118, The Unsuspected but Dangerously Tuberculous Cow.) Therefore, since the degree of the disease can only be determined by post-mortem examination, it seems clear that the possibilities of danger in leaving an apparently healthy reactor in a herd, which may at any time become a source for spreading new infection, far outweigh the pecuniary loss incident to the immediate slaughter of such an animal, even when considered from a solely economic point of view.

In the post-mortem inspection of these reactors it was found that 234 carcasses, or 76.72 per cent, contained lesions which were sufficiently localized to safely admit of their use for food purposes, while the remaining 66 carcasses, or 21.64 per cent, showed generalized or sufficiently extensive lesions of tuberculosis to require their condemnation to the fertilizer tank.

People sometimes express wonder that the flesh of a cow, healthy in appearance, condemned and slaughtered on account of reacting to the tuberculin test, can be considered wholesome for food purposes if any lesion of tuberculosis is found on post-mortem examination, while the same cow can not be considered equally safe to retain in the dairy for the production of milk. It should be observed, however, that the extent of the disease is only revealed at post-mortem; the lesions may on the one hand be slight and localized, not affecting the flesh of the animal, and the slaughtering absolutely disposes of the case, whereas, on the other hand, the healthy appearing reactor may excrete tubercle bacilli at any time, and is therefore a constant menace both to man and to other cattle. Her milk drawn twice a day may be more or less constantly contaminated, rendering it, as well as the butter, cheese, or other raw products manufactured from it, a source of danger to consumers.

Retests are necessary at proper periods in eradication work, not because of the failure of tuberculin as a diagnostic agent, but because of the contagiousness of tuberculosis and the readiness with which most cattle which are exposed become infected. There is a period of time between infection and the development of the tubercular lesion known as the period of incubation, during which period an exposed and infected animal will not react to the test. Thus an animal or animals in a diseased herd may be infected as the result of exposure

to their diseased associates or from the infected stables, but on account of the disease not having yet developed at the time of the testing of the herd they do not react.

Advanced or generalized cases of tuberculosis may also fail to react to the tuberculin test, because the temperature of an animal with an excessive amount of disease is not affected by the injection of the tuberculin. These latter cases can, however, be picked out by physical examination, so there is slight probability of any such being overlooked in a herd by a careful and painstaking veterinary inspector.

Again, there occasionally exists in a herd an animal with a healed tuberculous lesion, which lesion has become encysted or enveloped in a dense connective-tissue membrane. Such an animal will not react to the tuberculin test. At a later period, however, as a result of a slight new infection new tubercular foci may be started, or through some secondary inflammatory process the old tubercular process is given a fresh impetus and becomes progressive, all of which plainly shows the necessity for retests annually or semiannually, in accordance with conditions found at the primary test.

It is desired to emphasize the fact, however, that when an animal once typically reacts to the tuberculin test there is no use whatever of a retest, as such an animal may positively be classed as tuberculous. The retesting of a typical reactor is, in fact, actually a dangerous procedure, for, as has been frequently pointed out by this Bureau, the results from the injection in the retest may be nullified or so masked by the previous injection that the owner and the person applying the retest may be deceived, and thus a tuberculous animal be retained in the herd to act as a source or center of infection.

As previously stated, the work of retesting in the District of Columbia after the lapse of six months was started June 1, taking in order those herds from which reactors had been removed and slaughtered. At the present time (October 15, 1910) all herds of any size have been subjected to retest except the two Government herds (Soldiers' Home and Government Hospital for the Insane). The unfinished work consists of premises upon which one to three animals are maintained, the retesting of which will tend to decrease rather than increase the percentage of reactors on retests, as all these premises were thoroughly cleaned and disinfected after the removal of the reactors. It may be added that the above-named institution herds have been subjected to annual tests during the past several years.

The following table gives the details of the retesting, to date, of the cattle on each of the premises which proved to be infected on the application of the first test. It will be observed that the herds on premises Nos. 8 and 10 contained a larger proportion of reactors at

the time of retesting than any others, which fact has served to materially increase the total percentage of reactors on retests. The writer feels that in order that the work of eradicating cattle tuberculosis in the District of Columbia should have its due credit, attention should be directed to the adverse conditions obtaining in these two instances.

Retesting of cattle on infected premises in the District of Columbia. Results of original tests and retests after lapse of six months.

No. of premises.	Original tests.			Retests.		
	Total cattle.	Number passed.	Number reacted.	Total cattle.	Number passed.	Number reacted.
1	16	9	7	15	13	2
2	24	6	18	8	8	0
3	10	9	1	8	8	0
4	2	1	1	2	2	0
5	2	1	1	1	1	0
6	2	1	1	3	3	0
7	14	6	8	11	11	0
8	28	17	11	17	10	7
9	21	17	4	16	16	0
10	59	40	19	39	29	10
11	19	15	4	22	22	0
12	29	6	23	15	15	0
13	13	12	1	11	11	0
14	15	12	3	11	11	0
15	15	13	2	13	13	0
16	5	3	2	2	2	0
17	3	3	[a] 0	2	2	0
18	1	0	1	2	1	1
19	7	3	4	18	17	1
20	16	8	8	17	17	0
21	1	0	1	1	1	0
22	2	1	1	1	1	0
23	2	0	2	1	1	0
24	24	21	3	24	24	0
25	10	9	1	8	8	0
26	29	17	12	11	11	0
27	13	4	9	14	10	4
28	11	5	6	5	5	0
29	4	3	1	3	3	0
30	1	0	1	1	1	0
31	10	9	1	10	10	0
32	2	1	1	2	2	0
33	2	0	2	1	1	0
34	21	8	13	19	17	2
35	1	0	1	1	1	0
36	1	0	1	1	1	0
37	7	6	1	12	12	0
38	3	2	1	1	1	0
39	1	0	1	1	1	0

[a] There were no reactors among these cattle at the original test, but they were exposed by reason of mixing with the cattle on the adjoining premises, which were infected.

Retesting of cattle on infected premises in the District of Columbia. Results of original tests and retests after lapse of six months—Continued.

No. of premises.	Original tests.			Retests.		
	Total cattle.	Number passed.	Number reacted.	Total cattle.	Number passed.	Number reacted.
40	3	2	1	3	3	0
41	2	1	1	1	1	0
42	34	13	21	21	20	1
43	6	4	2	5	5	0
44	2	1	1	1	1	0
45	21	3	18	10	9	1
46	15	5	10	13	13	0
47	2	1	1	1	1	0
48	18	12	6	25	23	2
49	2	1	1	2	2	0
50	1	0	1	1	1	0
51	11	10	1	9	9	0
52	1	0	1	1	1	0
53	8	6	2	6	5	1
54	2	1	1	2	2	0
55	6	5	1	4	4	0
56	1	0	1	1	1	0
57	8	6	2	8	7	1
58	7	6	1	7	7	0
59	2	1	1	1	1	0
60	5	2	3	2	2	0
61	19	11	8	24	24	0
62	1	0	1	1	1	0
63	2	1	1	2	2	0
64	2	1	1	2	2	0
65	1	0	1	1	1	0
66	1	0	1	1	1	0
67	1	0	1	2	2	0
68	2	1	1	1	1	0
69	3	2	1	1	1	0
70	1	0	1	1	1	0
71	2	1	1	3	3	0
72	1	0	1	2	1	1
73	128	117	11	119	119	0
74	147	145	2	153	152	1
75	1	0	1	1	1	0
Total	915	627	288	788	753	35

In the first, the owner bought 3 cows which had passed the tuberculin test out of a herd of 21, the remaining 18 having reacted. In the other case the farmer denied the existence of the disease and opposed the tuberculin test and the subsequent work of disinfection, even claiming to disbelieve that the lesions of tuberculosis shown him at post-mortem were anything of a serious nature or in any way different from what he had observed in numbers of cows which he had seen slaughtered. There is no reason to doubt that he was cor-

rect in claiming to have seen plenty of similar conditions in cows when slaughtered, but his experience related to the slaughter of cows on the farm or at country slaughterhouses, where the tuberculous cow is commonly brought for final disposal. Unfortunately, however, in these instances there is generally no inspector at hand to prohibit the use for food purposes of such carcasses or portions of carcasses as are contaminated with the germs of a dangerously contagious disease.

Of the 75 premises originally infected according to the table, the number upon which a second infection was found was 13. Therefore the work so far accomplished has resulted in eradicating tuberculosis from 62 centers of infection. It should be noted, too, that more than one-half of the reactors on the retest were on 2 of the 13 premises. The percentage of premises showing a second infection is 17.33, and the percentage of reacting cattle on the retest is 4.47. But it should be observed that this percentage is based exclusively upon a retest of cattle on premises found to be infected in the primary test, whereas, if the percentage were based upon the whole number of cattle in the district, as in the case of the primary test, the percentage of reactors would be reduced to about 2, which is a great improvement upon the 18.87 per cent found by the original test. This result argues well for a speedy and total eradication of the disease from the cattle of the district.

[United States Department of Agriculture, Bureau of Animal Industry.]

ORDER OF THE COMMISSIONERS OF THE DISTRICT OF COLUMBIA FOR THE SUPPRESSION AND PREVENTION OF TUBERCULOSIS IN CATTLE.

EXECUTIVE OFFICE,
COMMISSIONERS OF THE DISTRICT OF COLUMBIA,
Washington, November 26, 1909.

Ordered: The Commissioners of the District of Columbia having learned that tuberculosis, a communicable disease, prevails among the cattle in the District of Columbia and adjacent States, do hereby, pursuant to law, authorize and direct the following measures for the prompt suppression and to prevent the spread of bovine tuberculosis within the District of Columbia and to adjoining States:

SECTION 1. It is hereby ordered that no cattle shall, in any manner, be removed from the District of Columbia except upon written permission from the Chief of the Bureau of Animal Industry or the Health Officer of the District of Columbia, which removal shall only be granted for cattle which have successfully passed an official tuberculin test, or are for immediate slaughter at an establishment at which United States meat inspection is maintained.

SEC. 2. Any person, firm, or corporation desiring to bring any cattle into the District of Columbia, except as provided in section 3, paragraph (*c*), shall first make application and obtain a permit from the Chief of the Bureau of Animal Industry or from the Health Officer of the District of Columbia. The said application shall be in writing, stating the number, sex, and the age of the cattle, whether over or under 6 months old, the exact place, date, and time at which it is desired to enter said cattle, and their destination within the District of Columbia, together with a declaration showing clearly the purpose for

which the cattle are desired to be entered, whether for immediate slaughter, feeding or breeding purposes, or for milk production.

SEC. 3. (*a*) Cattle offered for entry into the District of Columbia must be accompanied by a permit, as provided in section 2, and must be identified by an official veterinarian of the Bureau of Animal Industry or of the Health Department of the District of Columbia, and must be appropriately tagged before entrance is permitted, except as provided in paragraph (*c*) of this section.

(*b*) Cattle over 6 months old, for purposes other than immediate slaughter, unless accompanied by a satisfactory certificate of tuberculin test by a veterinary inspector of the Bureau of Animal Industry or an official veterinarian of the Health Department of the District of Columbia or of the State from which brought, must be immediately taken after identification, as provided in paragraph (*a*) of this section, to a place designated by the Chief of the Bureau of Animal Industry or Health Officer of the District of Columbia, and there quarantined apart from all other cattle until officially tuberculin tested and disposed of in accordance with these regulations: *Provided*, That no indemnity shall be allowed for such cattle as shall be slaughtered on acccount of their being deemed to be tuberculous. When accompanied by certificate of tuberculin test, as herein provided, the said certificate must show the place and the date, within thirty days, of being offered for entry, of inspection and tuberculin testing, also temperature chart, description of the animal or animals, age, markings, and tag numbers, if tagged.

(*c*) Cattle for immediate slaughter may enter the District of Columbia if tagged in accordance with paragraph (*a*) and without the tuberculin test, on condition that the tag therein provided for shall remain attached to the hide until removed in the presence of an employee of the Bureau of Animal Industry or of the Health Department of the District of Columbia, to either of whom it shall be delivered. The owner of the animal at the time of slaughter is hereby required to notify the Chief of the Bureau of Animal Industry or the Health Officer of the District of Columbia, stating the place where the hides will be found. If shipped in cars and consigned direct to an establishment having United States meat inspection, cattle for immediate slaughter may enter the District of Columbia without complying with section 2 and section 3, paragraph (*a*): *Provided, however*, That the consignee shall keep a complete record of each animal received, date of receipt, its place of origin, railroads traversed, name of shipper, and butcher class to which each animal belongs, and shall report the same before the slaughter of any such animals to the Chief of the Bureau of Animal Industry through the veterinary inspector stationed at that establishment.

(*d*) Cattle under 6 months old for purposes other than immediate slaughter, when not accompanied by certificates as indicated in paragraph (*b*), may be brought into the District of Columbia as provided in paragraph (*a*), but said cattle must be accompanied by affidavits by the breeder or feeder and by the owner or shipper; said affidavits to state that tuberculosis has not been known to exist on the premises, during the six months immediately preceding the offer for entry, upon which said animals have been kept.

SEC. 4. Cattle over 6 months old already within the District of Columbia shall be inspected and tuberculin tested by a veterinary inspector of the Bureau of Animal Industry or of the Health Department of the District of Columbia. Cattle under 6 months old shall, in the same manner, be inspected, and when deemed necessary shall be tuberculin tested, said inspection and tuberculin testing to be repeated annually, or at such times as the Chief of the Bureau of Animal Industry or the Health Officer of the District of Columbia may direct. All such cattle shall be officially tagged "U. S., B. A. I.," with a serial number, or "U. S., B. A. I., Reacted," with a serial number.

SEC. 5. All cattle already within the District of Columbia which are deemed to be tuberculous, either as a result of physical examination or the tuberculin test, shall be slaughtered within a time and at a place designated by the Chief of the Bureau of Animal Industry or the Health Officer of the District of Columbia, and shall be subject to official post-mortem inspection, and the carcass of any such animal shall be disposed of according to the meat-inspection regulations of the Bureau of Animal Industry. All such cattle shall be appraised before being slaughtered, the owners to be indemnified as hereinafter provided from any available appropriation made by Congress for the Bureau of Animal Industry of the United States Department of Agriculture for carrying out the provisions of the act of May 29, 1884, except as specified in section 8 of these regulations: *Provided*, That no liability shall be incurred under

these regulations by the United States Department of Agriculture in excess of the funds available from the aforesaid appropriation of Congress, and whenever the Chief of the Bureau of Animal Industry shall deem it necessary or advisable, because of the lack of funds for the aforesaid purpose, he shall notify the Health Officer of the District of Columbia to that effect, and thereafter no liabilities shall accrue against the United States on account of any act done or permitted under these regulations.

SEC. 6. (*a*) The Health Officer of the District of Columbia shall designate or request the Chief of the Bureau of Animal Industry to designate an appraiser, who shall appraise each animal within five days prior to the date of slaughter, basing the amount upon the class and market value of the animal at the time of the appraisal, whether for breeding purposes or for meat or milk production. Animals reacting to the tuberculin test but not exhibiting any physical evidence of tuberculosis shall be appraised without considering the presence of a diseased condition, but animals exhibiting any physical evidence of tuberculosis shall be appraised as diseased animals. The amount of appraisal shall not in any case exceed the sum of seventy-five dollars for a pure-bred and registered animal or the sum of fifty dollars for a grade or nonregistered animal. If the amount of appraisal of any animal, as determined by the appraiser designated, is not satisfactory to the owner or owners of such animal, a written notice of such fact, setting forth the reasons for complaint, shall be forwarded upon the day of appraisal to the Health Officer of the District of Columbia. The amount of the appraisal shall then be determined by arbitrators, one to be appointed by the Health Officer of the District of Columbia or the Chief of the Bureau of Animal Industry and one by the owner or owners of the animal or animals. If the said arbitrators are not able to agree as to the amount of appraisal, a third arbitrator shall be appointed by them, whose decision shall be final. Arbitrators shall be paid at a rate of compensation not to exceed five dollars per diem and necessary expenses. Compensation for the arbitrator appointed by the owner and the third arbitrator, if appointed, shall be paid from the fund of the United States Department of Agriculture if the decision made is against the arbitrator appointed by the Health Officer or the Chief of the Bureau of Animal Industry, but if the decision is in favor of such arbitrator the owner shall pay the compensation of the arbitrator appointed by him and the third arbitrator, if appointed.

(*b*) Following the appraisal of animals, in accordance with paragraph (*a*) of this section, the amount of reimbursement shall be determined by the results of post-mortem inspection according to the following rules:

Rule 1.—If any animal is found, upon post-mortem inspection, not to be affected with tuberculosis, the carcass and other edible portions shall be passed for food, and the owner shall sell the same, including all accompanying parts, for a reasonable price, which price shall be deducted from the amount of appraisal, and the balance, if any, thus remaining shall be paid from any fund available for that purpose.

Rule 2.—If any animal is found, upon post-mortem inspection, to be affected with tuberculosis, and the lesions are such that the carcass and parts of the carcass are passed for food, the owner shall sell the same, including all accompanying parts, for a reasonable price, which price shall be deducted from eighty per centum of the amount of the appraisal, and the balance, if any, thus remaining shall be paid from any fund available for that purpose.

Rule 3.—If any animal, upon post-mortem inspection, is condemned for offal, the owner shall sell the hide for a reasonable price, which price shall be deducted from forty per centum of the amount of the appraisal, and the balance, if any, thus remaining shall be paid from any fund available for that purpose.

SEC. 7. Any premises upon which there have been kept animals affected with tuberculosis shall be disinfected promptly after the removal of such animals, and in a manner satisfactory to the Chief of the Bureau of Animal Industry or the Health Officer of the District of Columbia, said disinfection to be at the expense of the owner or owners of the premises or of the owner of the animals.

SEC. 8. Any owner, shipper, or common carrier bringing any cattle into the District of Columbia in violation of these regulations will be liable to prosecution, and the cattle shall be immediately removed, at the owner's expense, from the District of Columbia. Such cattle, however, may remain in the District of Columbia if inspected and tuberculin tested under the following conditions: The owner or owners shall first sign an agreement providing for the inspection and tuberculin test by a veterinary inspector of the Bureau of Ani-

mal Industry or of the Health Department of the District of Columbia, and if any one or more of the said animals should then be deemed tuberculous, that he or they will cause such animals to be slaughtered in accordance with the specifications of section five of these regulations; and, further, that no claim for reimbursement for any loss which might be thus sustained will ever be made against the United States Department of Agriculture, or any other branch of the United States Government, or the District of Columbia, or any officer or department thereof.

SEC. 9. Any person violating any of these regulations, or entering cattle by fraudulent means, or using false or fraudulent tags, or interfering in any way with the work of any official, or using any false or fraudulent means to enable any cattle to pass the tuberculin test, shall be punished by a fine of not more than forty dollars nor less than five dollars.

The foregoing regulations shall go into effect upon their approval by the Secretary of Agriculture.

HENRY B. F. MACFARLAND,
HENRY L. WEST,
WILLIAM V. JUDSON,
Commissioners of the District of Columbia.

Approved, November 27, 1909.

JAMES WILSON,
Secretary of Agriculture.

NOTE 1.—On March 5, 1910, an amendment was issued to the above order permitting the unrestricted entry of calves under six months old and castrated cattle for immediate slaughter.

NOTE 2.—The States of Maryland and Virginia require tuberculin test for dairy and neat cattle entering from other States.

THE GAME MARKET OF TO-DAY.

By Henry Oldys,
Assistant Biologist, Biological Survey.

INTRODUCTION.

The game market of the United States is in a transition stage. The past history of the country has been marked by waste of its natural resources; the future will probably be governed by careful conservatism; we are at present midway between the two extremes, and this condition is reflected in the game markets, which show all the irregularity and inconsistency that naturally accompany a period of change. The older countries of the world long ago learned the lesson experience is now teaching us, and it is significant that England has more game to-day than several sections of equal area in the United States. The wasteful methods of the past have resulted in the hasty adoption of stringent restrictions on trade in game, which is the chief drain on the comparatively small supply of American game remaining. This sudden change of policy has excited the antagonism of the vested interests affected, and has been followed by a constant contest between officials charged with enforcing the new laws and market hunters and dealers whose former privileges have been curtailed. Some game markets, however, are as open at certain seasons as ever, though the former abundant supply is no longer displayed.

EARLY ABUNDANCE OF GAME.

The first colonists in America found the land teeming with game. The coasts and inland waters were covered with waterfowl; the forests were filled with deer, elk, wild turkeys, grouse, and smaller game; and the meadows and plains were swarming with prairie chickens and buffalo. During the migration period the waters were alive with waterfowl, and the bays and shores where swans resorted appeared as if dressed in white drapery.[1] "Mighty flocks of geese and brant" and "wild ducks innumerable" wintered in Virginia.[2] Wild turkeys, "the most important fowl of the country," were found in flocks of 20 to 40 in all wooded parts of the land, and were bought of

[1] Van der Donck, Adriaen, Description of the New Netherlands, 1653. Collections of the New York Historical Society, 2d ser., vol. 1, p. 174, New York, 1841.

[2] Clayton, John, A letter from Mr. John Clayton to the Royal Society, May 12, 1688, p. 33, 1688.

the Indians by the New Netherlands colonists for 10 stivers (20 cents) each (Van der Donck). Bobwhites and ruffed grouse were even more numerous, and were regarded as too insignificant to spend powder on. In colonial days Massachusetts even placed a bounty on ruffed grouse to protect crops. The heath hen, or eastern prairie chicken, now confined to Marthas Vineyard and reduced in numbers to about 200, furnished an abundant article of diet to the colonists in New England and New Netherlands—so abundant, in fact, that articles of apprenticeship often specified that apprentices should not be compelled to eat its meat oftener that twice weekly.[1] Pigeons were innumerable. The Indians used to gather in bands of 200 or 300 at their nesting places and feast for a month or more on squabs (Van der Donck), and dressed pigeons were sold in Boston for threepence a dozen.[2]

Big game was plentiful. A good buck could be bought in New Netherlands for 5 guilders ($1.20) and often for much less (Van der Donck). The northern woods were filled with moose. Elk were so abundant that a hundred might be found in spring "within the compasse of a mile" (Morton). Buffalo were numerous in all open country. A settler at Onondaga Lake, in central New York, estimated that 10,000 buffalo were accustomed to visit the salt springs on his place. In two years he and some companions killed 600 or 700 for their skins, which brought 2 shillings each.

The settlement of the country, at first comparatively slow, has latterly been exceedingly rapid. The line of advancing settlement required one hundred and sixty-one years to extend from the coast of Virginia into Kentucky (1606 to 1767), and nearly a century later it had scarcely crawled beyond the edge of the Great Plains, while now there is hardly a square mile of tillable land in the entire country which is not settled. Though many spots are yet so wild as to permit a harbor (though not a safe one in open season) where native game may still be found in moderate abundance, and though migratory game birds breeding in northern wildernesses may yet pass in spring and fall with some suggestion of the former myriads, yet the important game of America is nearly gone and without great conservatism in the immediate future will shortly disappear.

It is interesting to note how late game has continued to be abundant in some regions. A New York newspaper for July 23, 1772, advertising the sale at public auction of a tract of more than 100 acres located in what is now Harlem, in the city of New York, stated that it abounded with "wild fowl, as ducks, geese, pidgeons, quails, etc."[3] On Long Island about the close of the eighteenth century "immense

[1] Report of Massachusetts Commission of Fisheries and Game for 1907, p. 56, 1908.

[2] There is now apparently but one passenger pigeon left, a female, 17 years old; held in captivity in the Zoological Garden of Cincinnati.

[3] De Voe, Thos. F., The Market Book, p. 137, New York, 1862.

quantities of game and deer" were "found amidst the brushwood," and "great numbers" were "annually killed, as well for the New York market as for the support of the inhabitants of the island."[1] In 1870 the prairie chicken was said to be "found in most Western States, but in the greatest abundance in Illinois, Iowa, and Minnesota, Iowa standing preeminent in this particular;" and "carload after carload," it is stated, were shipped every winter to the seaboard cities;[2] and in 1874 it was said to occur "in myriads" at Council Bluffs, Iowa.[3] In 1906 the State fish and game warden of Iowa reported to the Biological Survey that the prairie chicken was "very scarce" in the markets of Council Bluffs and other Iowa towns, the few that were on sale having been imported from Minnesota and the Dakotas, and added: "Prairie chickens are becoming more rare in our State every year. * * * Their natural breeding place is in the wild-hay lands, which are becoming very scarce in this State." As late as 1892 game of all kinds was reported as plentiful in the Ozark Mountains of Missouri, and small game was so abundant that it was practically ignored by the natives.[4]

Such accounts might be multiplied indefinitely. These are sufficient, however, to show how recent and rapid has been the change from abundance to comparative scarcity in many regions as settlement has advanced and to point out how imminent and yet unperceived may be the danger of extermination of many species. Even to-day accounts are published of the enormous and supposedly inexhaustible supply of game in regions where, within a decade or two, the sportsman will probably be making earnest attempts to restock exhausted covers.

INCREASE IN PRICES OF GAME.

As game has decreased, prices have risen. By 1763 game had been so reduced, especially along the Atlantic coast, that although a short distance inland there was an apparently limitless supply, the growing scarcity had begun to manifest itself in the markets. On August 24, 1763, a committee selected by the "freemen and freeholders" of New York to "assize" market prices of meats and provisions, published the following schedule of the prices for game:[5]

Venison (maximum price)	per lb	5d.
Pigeons	" doz	18d.
Quail	each	1½d.
Heath hens	"	15d.
Partridges	"	1s.

[1] Weld, Isaac, Jr., Travels through North America during the Years 1795, 1796, and 1797, p. 463, London, 1799.
[2] Fur, Fin, and Feathers, p. 155, New York, 1870.
[3] Coues, Elliott, Birds of the Northwest, p. 420, Washington, 1874.
[4] Shewey, Arista C., Shewey's Guide and Map to the Happy Hunting and Fishing Grounds of Missouri and Arkansas, p. 5, St. Louis, 1892.
[5] De Voe, Thos. F., The Market Book, p. 142, New York, 1862.

Black and other large ducks	each	1s.	
Teal and other small ducks	"		6d.
Turkey cock	"	5s.	
Turkey hen	"	3s.	6d.
Turkey cock (poult)	"	2s.	3d.
Turkey hen (poult)	"	1s.	9d.
Wild goose	"	2s.	
Wild goose (immature)	"		18d.
Brant	"		15d.
Snipe (large)	per doz.		15d.
Snipe (medium)	" "		12d.
Snipe (small)	" "		6d.
Other small birds	" "		6d.

It is interesting to compare these prices with the following (wholesale) prices in the New York markets in 1910.[1]

Grouse, domestic	per pair			$3.00
Grouse, foreign	" "	$1.25	to	1.75
Partridge, domestic	" "	3.50	"	4.00
Woodcock, domestic	" "	1.50	"	2.00
Golden plover	per dozen	2.50	"	3.50
English snipe	" "	2.00	"	3.00
Canvasback duck	per pair	2.25	"	3.00
Redhead duck	" "	1.50	"	2.50
Mallard duck	" "			1.25
Bluewing teal	" "	.75	"	1.00
Greenwing	" "	.75	"	.90
Broadbill duck	" "	.50	"	.75
Rail, No. 1	per dozen			1.00
Rail, No. 2	" "			.60
Venison, whole deer	per pound	.22	"	.25
Venison, saddle	" "	.30	"	.35

The advance in prices can be well shown by a comparative statement of the price of a whole carcass of venison. Assuming that a large deer, such as would find its way readily to the New York market, would weigh 175 pounds, and remembering that an English penny is about 2 cents, we can compare the prices of 1653, 1763, and 1910 thus:

1653. Whole deer, $1.20.
1763. Whole deer, $17.50 (maximum price).
1910. Whole deer, $43.75 (maximum price, wholesale).[2]

The comparison in the table below of some New York prices of 1763 and 1910 with London prices of 1910[3] for the same or similar game, yields significant results.

[1] New York Journal of Commerce and Commercial Bulletin, Oct. 20, 1910. The wholesale prices of New York are used merely for purposes of comparison with the earlier prices in the same market. They must not be taken as typical of general market prices throughout the United States in 1910.

[2] It is worthy of remark that in Alaska, which is the last part of the United States to be exploited, a whole deer could be bought at Ketchikan in 1908 for $1.50, very little more than was paid by the Dutch settlers in New Netherlands in the seventeenth century.

[3] Taken from the London Times for October 14, 1910.

Comparative prices of game in the markets of New York in 1763 and 1910 and of London in 1910.

Game.	New York, 1763.	New York, 1910.	London, 1910.
Partridge	$0.24	$1.75 to $2.00	$0.16 to $0.24
Grouse [1]	.30	1.50	.24 .36
Mallard duck	.24	.62½	.24 .36
Teal	.12	.37½ .50	.16 .24
Snipe (per dozen)	.30	2.00 3.00	.08 .16

[1] Heath hen in the New York markets of 1763.

It will be noticed that the London prices of 1910 correspond much more closely to the New York prices of 1763 than to the New York prices of 1910.

PRESENT CONDITION OF GAME.

The last wild buffalo of the United States outside of the Yellowstone National Park was killed in 1897. Antelope, elk, and moose will probably survive a little longer, while deer, under favorable conditions, will hold their own for some time to come. The original range of the buffalo extended from central New York to eastern Oregon and from northern Mexico to Great Slave Lake, nearly touching the Atlantic coast in Georgia and the Gulf coast in Louisiana. By 1730 the last buffalo east of the Alleghenies had been killed. By about 1810 none were to be found east of the Mississippi. In 1870 those that were left were confined to two great herds, the southern of which roamed the plains of eastern Colorado and New Mexico, southern Nebraska, western Kansas and Oklahoma, and northern Texas, while the northern herd ranged from northwestern Nebraska and western Dakota on the east to Montana and Wyoming on the west, and northward into Canada to the northern limit of the original range of the species. Twenty-seven years later not one was left in the United States except a few in captivity.

The elk was originally found as far east as the seaboard States and westward to the Pacific coast. By 1850 it was still to be seen in southern New York and northern Pennsylvania and in the Allegheny Mountains in Virginia. It lingered in Michigan until 1877 and in the Ozarks in Missouri as late as 1898. There are now fairly large herds in Montana, Idaho, and western Wyoming, and a few small ones scattered in four or five other Western States.[1]

The American antelope, the only antelope found in the Western Hemisphere, which originally roamed the plains and prairies of the

[1] The elk was reintroduced in the Adirondacks in New York in 1901, and the original stock of 22 has multiplied until by December 31, 1907, it was estimated that the herd numbered 425. About 50 elk, which probably escaped from the Austin Corbin preserve, are now running wild in New Hampshire.

West in countless numbers, in 1900 still covered a large area, but in isolated and rapidly diminishing herds. By 1908 these herds had been so reduced that it was possible to form the following fairly close estimate of the remaining numbers: Colorado, 2,000; Idaho, 200; Montana, 4,000; New Mexico, 1,300; Oregon, 1,500; Wyoming, 4,000; Yellowstone National Park, 2,000; other States, 2,000; total, 17,000.

Moose, which have always made their home in the northern woods of the country, have fared better. In the eastern half of the country they still occur in Maine and Minnesota, and in the West in western Montana, northeastern Idaho, and the Yellowstone National Park and adjacent territory in Wyoming.

Deer have been able to maintain themselves much better than other big game; still, in about one-fourth of the States they have either been killed off or become so scarce that no hunting is permitted, and in the rest are generally confined to restricted localities.

Quail have been reduced almost to the vanishing point in the Northern States, but are still fairly plentiful in the middle belt and are moderately abundant in the South. Wild turkeys originally furnished the colonists with an unfailing supply of food and were so abundant as to strike all visitors to the country as the most prominent and conspicuous of the inland game birds. Now they are comparatively rare. None are left north or east of Pennsylvania, but in some localities in the South, particularly where settlement has been slow, they are yet found in fair abundance. Prairie chickens are still somewhat abundant in a few regions in the Mississippi Valley, especially in Nebraska and South Dakota, yet from the rapid settlement in that section and the ease with which the birds may be secured they will undoubtedly continue to show a swift decrease.

The various species of grouse that inhabit the country west of the Mississippi are similarly doomed, except that some few may survive in the interior of unreclaimed deserts or in the fastnesses of mountains. Their extermination in all accessible places is dependent merely upon the rapidity with which such places are utilized for agricultural and other purposes. The same is true of the ruffed grouse of the East. This bird, once so numerous as to be rated in the Massachusetts colony as a pest, is now carefully protected throughout its range, and in the few markets in which it is still on sale sometimes brings as high a price at retail as $5 a pair (New York, 1910). The growing scarcity of the woodcock was discussed in the Yearbook of the Department of Agriculture for 1903.[1] Of waterfowl it may briefly be said that numerous as they may at times still appear to be, yet compared with their original abundance they are but few. Furthermore, although in the fluctuations produced by climatic and other natural causes they may seem at times to be

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[1] Fisher, A. K., Two Vanishing Game Birds.

recovering some degree of their former abundance, yet we must not allow these occasional years of comparative plenty to blind us to the rapid decrease which is in progress.

CAUSES OF DECREASE.

In seeking the reason for the immense decrease in the game of the country we have not far to look. The recklessness with which the early colonists destroyed the game that filled this land to overflowing is astonishing, even though such wasteful methods are usual in a new country. We find them selecting haunches of venison and leaving the rest of the carcass to the dogs and beasts of prey; giving wild geese to their dogs; and burning canebrakes, thus destroying the haunts of many game animals and birds, merely to secure a day's kill. Such practices continued to prevail on the border line of settlement as it advanced westward, and late in the last century numbers of slain buffalo were left to rot after their tongues had been cut out.

As settlement progressed, a new and far more potent agent of destruction arose in the growing and unregulated trade in game. Just as our forests have been converted into lumber at the demands of trade, so meadow and forest have been depleted of game for commercial reasons. The destructive power of unrestricted trade in game has latterly been greatly intensified by the development of cheap and rapid transit and of cold storage; and had it not been for the final adoption of measures limiting the market supply, our game would be practically gone, or at least utterly beyond the reach of the moderate purse.

A third factor which has operated to reduce our stock of game, and one of no less importance than the other two, has been the conversion of wild into cultivated land. Forests have given way to plowed fields, meadows have been tilled, and swamps have been drained. These places when wild furnish suitable homes for game animals and birds, and their occupancy by man has permanently reduced the stock of game by depriving it of available shelter. As the country is more and more occupied by man, it must necessarily be less occupied by game; hence we can never hope to restore former abundance. Nevertheless, by adopting methods of conservation adapted to present conditions we should be able to preserve a fair supply of game indefinitely.

RESTRICTIVE LAWS.

Along with the disappearance of game has grown up a system of restrictive State laws. States have not, however, kept pace with the increasing need of protective measures, but have acted rather on the

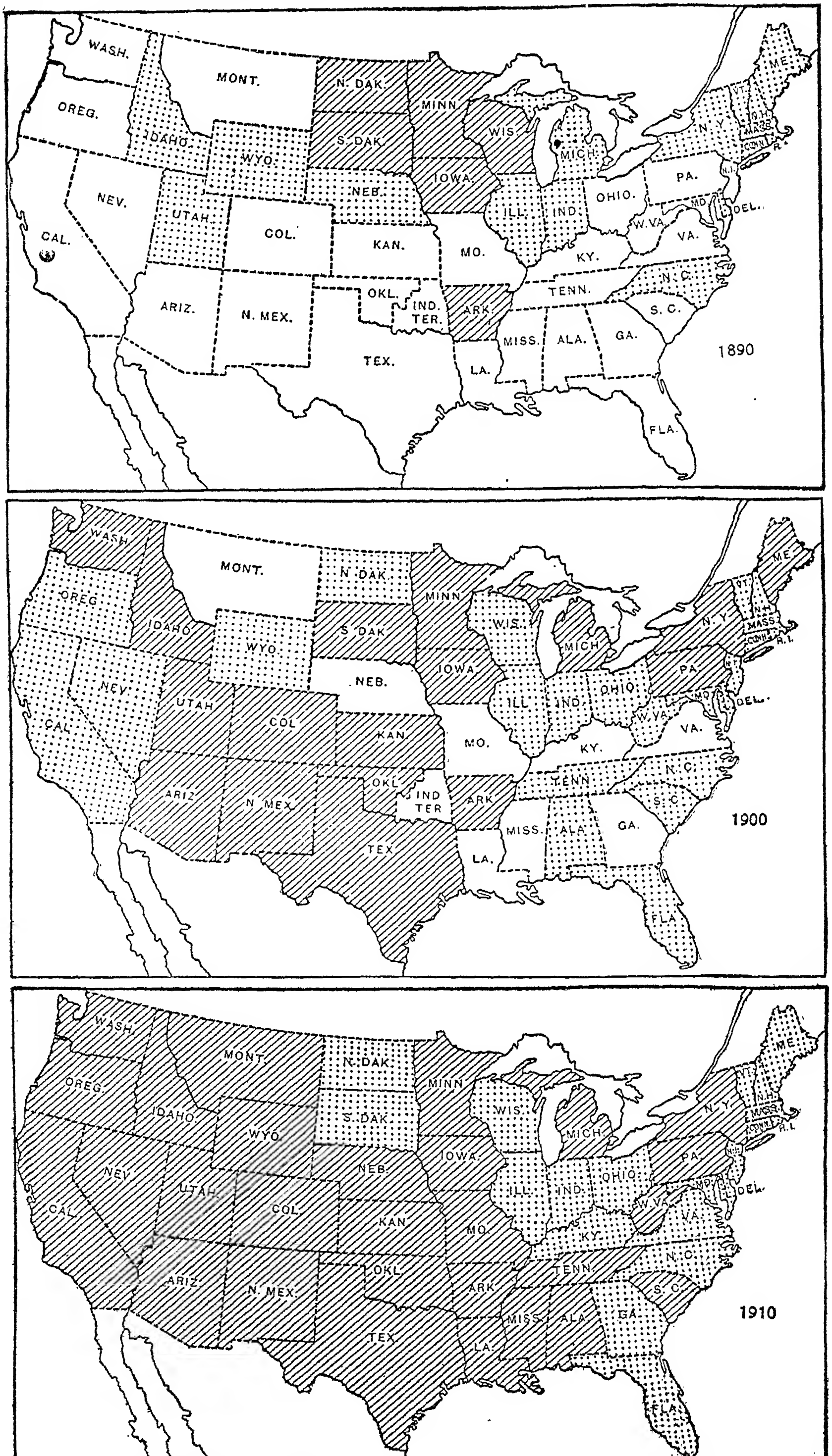

Fig. 1.—Maps showing States prohibiting export of all game (ruled) or certain species (dotted) in 1890, 1900, and 1910.

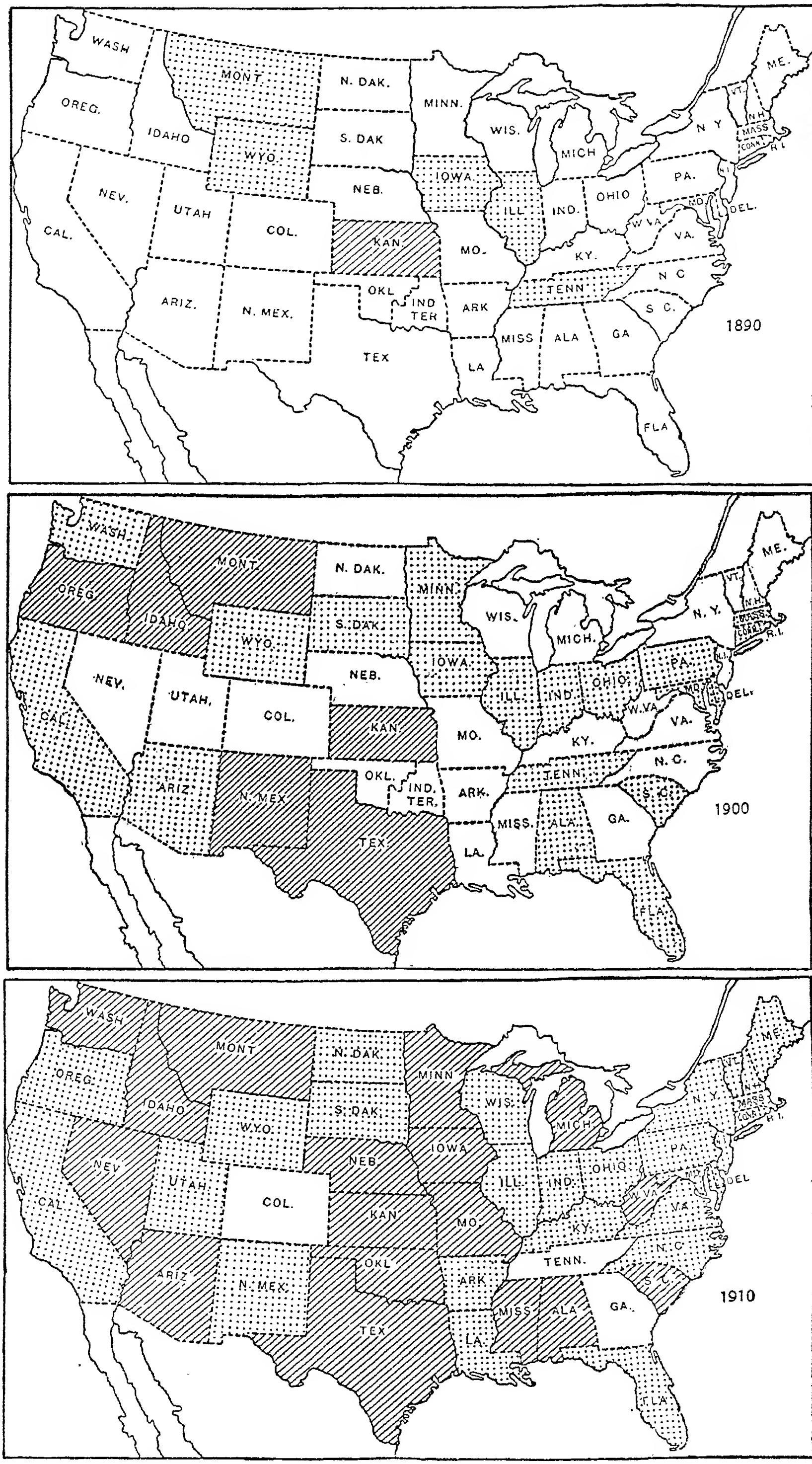

FIG. 2.—Maps showing States prohibiting sale of all game (ruled) or certain species (dotted) in 1890, 1900, and 1910.

principle of locking the stable door after the horse has been stolen. Game legislation has usually followed a well-marked course. First, hunting in the season of reproduction has been prohibited; then methods of hunting have been restricted; then sale and possession of game in close season have been interdicted; next, all hunting of certain species has been suspended for a term of years, in order to allow recuperation; then discrimination against nonresidents has followed; and, finally, bag limits have been imposed and resident licenses established. These provisions are mainly directed to the hunting of game, but with the growing importance of the game market it has been found essential to deal with this phase of the subject by licensing market hunters, prohibiting export of game, forbidding sale at all times, or combining all these features.

Laws prohibiting all sale and export of game are comparatively recent. Their necessity under the existing conditions was readily recognized and the growth of such restrictive legislation was very rapid, as is indicated by the accompanying maps showing the States that prohibited sale and export at all times of all or part of their game in 1890, 1900, and 1910, respectively. (See figs. 1 and 2.)

MARKETS.

The principal game markets of the United States are Chicago, New York, Philadelphia, and Boston. Until recently St. Louis belonged in the list, but the legislature of Missouri passed a law in 1909 closing the game markets of the State. Prior to that time St. Louis had been the depot for ducks of various kinds from Arkansas, Texas, and other States, quail from Kansas and Oklahoma, prairie chickens from Nebraska and South Dakota, and deer from southern States. Some of this game was distributed to smaller markets in Missouri, Iowa, and Illinois, but much of it passed on to Chicago, there to be distributed to various eastern markets. Chicago draws on Michigan and Wisconsin for part of its supply of venison and receives much southern game direct. New York, besides obtaining game from Chicago, serves as a depot for game from surrounding points, such as the Susquehanna Flats and the Long Island coast, which furnish large supplies of waterfowl. It is the chief distributing point for game imported from Europe, such as quail, grouse, woodcock, black game, plover, pheasants, partridges, and deer. Boston probably stands first in the trade in deer, derived chiefly from Maine. Philadelphia is supplied largely from local sources, but has obtained quail direct from points as distant as Oklahoma or Texas and deer direct from Canada and North Carolina.

The game market is closed in Detroit, Milwaukee, St. Paul, Minneapolis, and Omaha, and to all game but waterfowl and rabbits in

San Francisco, and all but rabbits in Cincinnati, Cleveland, and Columbus.

Low prices prevail at New Orleans, and also characterized the St. Louis market when it was open. Chicago and New York prices run rather higher, and those of Boston still higher. Philadelphia prices are moderate, those of Baltimore and Washington lower, and those of Richmond, Va., very low, almost rivaling the prices of the New Orleans market. In other cities prices vary considerably; as a rule, however, the less important the market the lower the prices, though there are some striking exceptions.

A few years ago much of the game on sale in the principal markets, particularly in the Middle West, was illegally procured. But since the passage of the Lacey Act and the establishment of more efficient warden service in the various States, the Department of Agriculture and State officials have been able to cooperate more effectively and most of the illegal traffic has been suppressed.

PRESENT MARKET SUPPLY OF GAME.

Deer are fairly plentiful in the principal markets, though scarce in Washington, New Orleans, and Denver. Quail are at present more plentiful than they were a few years ago, and can be bought at from $2.50 to $5 a dozen, according to the market. Ruffed grouse are scarce everywhere, and prairie chickens are practically out of the markets; both species are frequently replaced by guinea fowl, which masquerade as grouse on the tables of hotels and restaurants. Wild turkeys are scarce or absent in all markets; woodcock also are scarce, and usually retail for 75 cents each; snipe and other shorebirds are generally absent, and are not much in demand; ducks are still plentiful in all markets, though local conditions sometimes diminish the supply. Canvasbacks and redheads command high prices in the East, owing to their quality. Canvasbacks, sometimes sold as high as $7 a pair in Washington and Baltimore, bring only $7 to $9 a dozen wholesale at San Francisco. Mallards usually range from 75 cents to $1.25 each—double the price of the small ducks. Rabbits are plentiful, and furnish a cheap and constant supply of food.

FOREIGN GAME.

The invasion of the American game market by foreign game is significant. Game is not only more plentiful and cheaper in European than in American markets, but it is sold at a lower price in the United States than corresponding American game. Thus we find foreign plover selling in Boston at $3.50 a dozen, while native plover in the same market are bringing $1.20 a pair, and in Chicago English partridges offered for $12 a dozen, while ruffed grouse are quoted at $22 a dozen. The principal reason for this apparent anomaly is that the European game markets are largely supplied by private

preserves, which are comparatively few in number and near the market, and which can maintain their stock at a fairly constant point; while the American supply is obtained from distant and numerous sources and is derived from wild and practically unregulated stock. Another reason is to be found in the greater restrictions in the United States on commerce in game. In Europe game may be sold and transported freely in the open season, while in America sale and transportation are necessarily greatly limited. Free marketing of wild game leads swiftly to extermination, while game reared as private property may be marketed freely without reducing the stock.

CONCLUSION.

From the foregoing considerations it will be perceived that the game market of the United States has constantly decreased in importance as game has become less and population has increased. From a time when bounties were paid for ruffed grouse and apprentices appealed from a diet of prairie chicken, we have reached the time when ruffed grouse are within reach only of the rich and prairie chickens are not to be had at any price. The meat of all big game except deer has been withdrawn from the market, and in many large cities even deer are not in the market, either because of nonsale laws or owing to the limited supply. Rabbits and waterfowl are still offered in some numbers, and quail are on sale every open season in a number of cities; but wild turkeys, once so abundant that colonists shot them from their doorways, are rare in northern markets and are found in very limited quantities in the South; while native woodcock and other shore birds are sold only in small numbers, if at all. The period has arrived when European pheasants, grouse, and plover are rapidly replacing corresponding American birds; and unless suitable measures be adopted for preserving and increasing our own game, we shall doubtless have to depend more and more on imported game for our market supply.

PROGRESS IN SAVING FOREST WASTE.

By William L. Hall,
Assistant Forester.

We are a people of rapidly changing customs. The farmer of to-day employs materials and processes that differ from those of fifty years ago. The banker, the merchant, the teacher, each works by a system different from that of half a century back. Fortunately, most changes result in improvement. We find better materials and processes and discard the old ones. The tallow candle was superseded by the kerosene lamp, the kerosene lamp by the gas jet, the gas jet by the electric bulb, and now we are working out infinite improvements of the electric light. It is much the same in the case of power. First, we had human power unaided, then man made a mighty step in advance by subduing the ox, the horse, and the camel to do his work. Another step, and the seas carried his commerce in wind-pushed ships; another, and coal-generated steam multiplied ten times his power and his speed on sea and land; still another, and to-day we have the realization of man harnessing the rivers and directing their energy to transportation in commerce, the lighting of cities, the turning of mills.

The use of the forest, though constantly changing in practice, has been continuous from the earliest times. All the peoples of the world, regardless of race or state of civilization, have made use of wood wherever it could be had. We are told by those who may be assumed to know, that in Persia are great hills of ashes—the remains of the wood fires of the fire-worshippers kept alight through untold ages before Abraham came to Haran from his native Chaldea. Thus the record written in the earth itself is evidence of the dependence of primitive man upon the products of the tree, even before history began.

The Anglo-Saxon has never been without his forest. Whether among his clan upon the Weser, under his overlord along the Thames, or in his sovereign States in the valley of the Mississippi, he has had his tree to cut at will for fuel, to construct vehicles of transportation, or to build his shelter. Wood has been the cheapest, the most accessible, and the most easily worked of all materials available for the use of man. We have used it everywhere and for everything. One of our best-known foresters has said, "Our civilization is built on

wood. From the cradle to the coffin, in some shape or other, it surrounds us as a convenience or a necessity."[1] A simple enumeration of the myriad uses of wood would extend to great length.

Under such universal demands, the consumption of wood grew apace. Considering only the one largest demand upon the forest—that for sawed lumber—we find that 18,000,000,000 board feet were used in the United States in 1880, 24,000,000,000 in 1890, 35,000,000,000 in 1900, and 40,000,000,000 in 1907. In addition we use wood in many other forms, such as hewed railroad ties, poles, and pulp. Our use of this material has come to exceed greatly that of any other people. Taking into account the whole tree, we take from our forests probably 125 cubic feet per capita annually; Germany uses only 37, and France but 25.

SUBSTITUTION OF OTHER MATERIALS.

Although our demand for wood outgrew our increase in population between 1880 and 1900, a change is now noticeable in this relation. The products of the forest reached their highest price in 1907, while the greatest production was in 1909. In 1907 the demand was equal to the supply. Since 1907, production has increased over 10 per cent while the demand has no more than remained steady and has probably declined. At present there is a marked condition of overproduction. The reason in great part is that substitutes are taking the place of enormous quantities of lumber and are thus exerting a powerful influence to lessen the demand for wood. In cities, steel and cement for frames; slate, metal, and patented materials for roofing; tile and cement for flooring, and marble for wainscoting and finish, have usurped places once belonging to wood. On the railroads, steel passenger and freight cars are displacing wooden ones, steel and concrete bridges and trestles are coming in and those of wood are going out. The best railroads consider frame depots and board platforms things of the past. The situation is similar on farms and in rural communities. Cement is relieving the pressure upon the lumber supply by coming into use where wood was once the only material employed. A list of such uses would properly include fence posts, well curbs, walks, feeding and watering troughs, swine houses, silos, greenhouse beds, feeding floors, milk rooms and cooling tanks for dairies, root cellars, floors for corn cribs, cow sheds, chicken houses, and for numerous other uses about the farm where lumber was formerly employed almost exclusively.

HOW WASTE OCCURS.

The principles which underlie the intelligent use of a valuable resource like the forest are to utilize it economically and, if possible,

[1] B. E. Fernow, Economics of Forestry.

provide for the renewal of the supply. Fortunately the forest, unlike the minerals, is a renewable resource. Like the cereals, trees grow, and with intelligent management produce one crop after another.

Much is known about the growing of trees, and considerable tree planting is being done. The schools are teaching both the sentiment and practice of tree planting, and individuals, cities, States, and the National Government are doing much work along this line.

Upon the first principle of forestry, that of using the present supply economically, our knowledge is altogether too limited and our practice entirely inadequate. The wood which we cut in the forest each year, if compacted together, would form a solid cube one-half mile in dimensions. It is taken from the forest to meet the demands of many industries. The lumber industry takes 42 per cent; cordwood, 32 per cent; fence posts, 9 per cent; hewed railroad ties, 7 per cent; cooperage stock, 2 per cent; and pulpwood, 2 per cent. Minor industries consume the remaining 6 per cent.

In the course of manufacture of sawed timber and its use by the industries, 67 per cent of the wood which grew in the tree is lost. In cordwood the loss is 5 per cent, and in posts and rails 20 per cent. In hewed cross ties the waste runs to 70 per cent, none of which can be used; and in cooperage stock it is even greater, amounting to 78 per cent.

It will at once be asked why this enormous waste occurs. The answer is easily found. We saw lumber with square edges, but the trees grow round. Our boards and timber must be straight and of the same width and thickness throughout, while the tree often grows crooked and always tapers. If the tree would accommodate us by growing with square edges instead of round, or even in the form of a cylinder instead of a cone, the waste would be less. Even then it would be considerable. There is waste in the stump because it is difficult to cut off the tree even with the surface of the ground, though it would be better for the forest if this were done.

Perhaps the greatest item of waste in the woods is found in failure to utilize the tops. Branches and tops are lopped off and left to decay on the ground. It is the dead tops with their clinging leaves and small branches that form the "slash" which burns with uncontrollable fierceness during disastrous forest fires. Thus one form of waste leads directly to another. Even this is not all the waste that takes place in the woods. Defective trees, due to burns, decay, or insects, are often left uncut. Sound logs are overlooked in the forest, or sink in the streams while in the course of transportation to the mills. Altogether, it is probably true that 25 per cent of the wood which is produced by growth is never taken from the forest at all.

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Let us see what occurs when a log actually goes to the sawmill. In the process of sawing out the rough boards the slabs, edgings, and trimmings must be removed. Besides, the bark and the sawdust—very considerable items—are lost. To be sure, the best slabs are frequently used to make lath and other small products, but the waste is but slightly reduced by this utilization. A large part of the product turned out as boards must then go through the planing mill, where from one-eighth to one-quarter of an inch is taken off in giving true, smooth surfaces. In all, mill waste, as represented by slabs, edgings, trimmings, shavings, and sawdust, easily comprises 35 per cent of the wood which originally stood in the forest.

This is not the end of the story. Further waste is entailed in working up lumber in the building trades; in box and furniture manufacture; in vehicle, car, and ship building; in fact, wherever sawed lumber is used. We must add to the 60 per cent of the tree left in the woods or lost at the sawmill 7 or 8 per cent more, which is sawed, planed, or chiseled off in the course of remanufacture. To sum up, the total wastage where the tree is sawed into lumber foots up to approximately two-thirds of the original volume.

In the case of timber which is hewed into railroad ties, cut into fuel wood, split into fence posts, or ground into pulp, a waste occurs in a manner very similar to that which occurs in the sawmill. Not until the piece of wood has taken its final form in house, box, table, barrel, or railroad tie does waste cease, and, in fact, not even then. No sooner does man cease cutting away with his ax, saw, chisel, or plane than other agencies actively take up the work. Decay, fire, insects, marine borers, and mechanical abrasion are especially active agents of destruction, and are estimated to cause an annual loss of over nine billion board feet of wood actually in use. Of this amount it is estimated that decay is accountable for 81 per cent, abrasion or wear 8 per cent, insect destruction 5 per cent, and destruction by fire and marine borers 3 per cent each.

HOW THE WASTE IS BEING SAVED.

If the enormous waste which is sustained in the utilization of the forest existed without any effort being put forth to abate it, the prospect would be deplorable. However, the industries which utilize the forest are making genuine effort to lessen the proportion of wasted material. This movement has been under way for several years, and while it has not progressed to the point of reducing to any great extent the total amount of the waste material it has made real advancement in many directions. It is the chief purpose of this paper to note the lines along which this advancement is taking place.

As already seen, waste in the material which makes up the tree takes place in the forest, during manufacture, and while in service.

At which point is it most important commercially to put a check upon this waste? Evidently, upon that waste which occurs after the timber is actually put in service, because there the wood has its greatest value. Take the railway tie, for instance. When the tie is newly laid in the track it has its highest value. Decay there means not only the cost of a new tie, but the cost of transportation and of placing it in the track as well. It is a sound business principle that the wood-using industries should as the first step begin to conserve their wood materials by protecting them in use so that they will last as long as possible.

For this reason we are now beginning on an extensive scale to treat with preservatives the timbers which are most subject to damage in use. These are railroad ties, bridge timbers, paving blocks, posts, poles, and piling. The time is close at hand when we shall find it practicable to treat with preservatives the shingles on our houses, our porch floors and columns, and other parts of buildings which are subject to decay. The preservative treatment of timber is rapidly becoming a substantial industry. Some 80 plants are now in operation, and more are being built every year. Many of these plants belong to railroad companies, while others do a commercial business. Two preservatives are widely used in the United States. One is creosote, a product of coal tar, valuable for preventing both decay and destruction by marine borers; the other is zinc-chlorid, a water-soluble salt, and effective only against decay. In 1908 57.5 million gallons of creosote and 19,000,000 pounds of zinc-chlorid were required for these uses, and applied to approximately 1,375,000,000 feet of timber.

Before long we shall undoubtedly see some of the larger lumber companies putting in preservative plants at their sawmills. The advantage to the lumberman would be that he could profitably turn much of his low-grade lumber and wood waste, by treatment with preservatives, into merchantable railroad ties and similar commercial products. This would mean a reduction of the amount of timber going into low grades of lumber—an end which the lumberman very much desires, since he has too little of the best lumber and too much of the poorest. The advantage to the country would be a closer utilization of the trees which are cut and a saving of much of the high-grade woods which are now going into inferior uses. It is poor economy to put the best white oak into railroad ties, which last in an untreated condition only seven or eight years, when treated ties of rapid-growth pine and gum will last from twelve to fifteen; yet this has been the practice.

Again, preservative treatment is making available large amounts of dead timber, which were until recently considered useless. Upon

the high mountains of the West are great areas covered with billions of feet of dead pine, spruce, and fir, the result of forest fires, some of which occurred a quarter of a century ago. Two National Forests, the Holy Cross and Sopris, in Colorado, are estimated to contain 165,000,000 feet of such timber. Much of this timber is still sound. If treated, it will be first-class material for fence posts, railroad ties, telephone poles, and mine timbers.

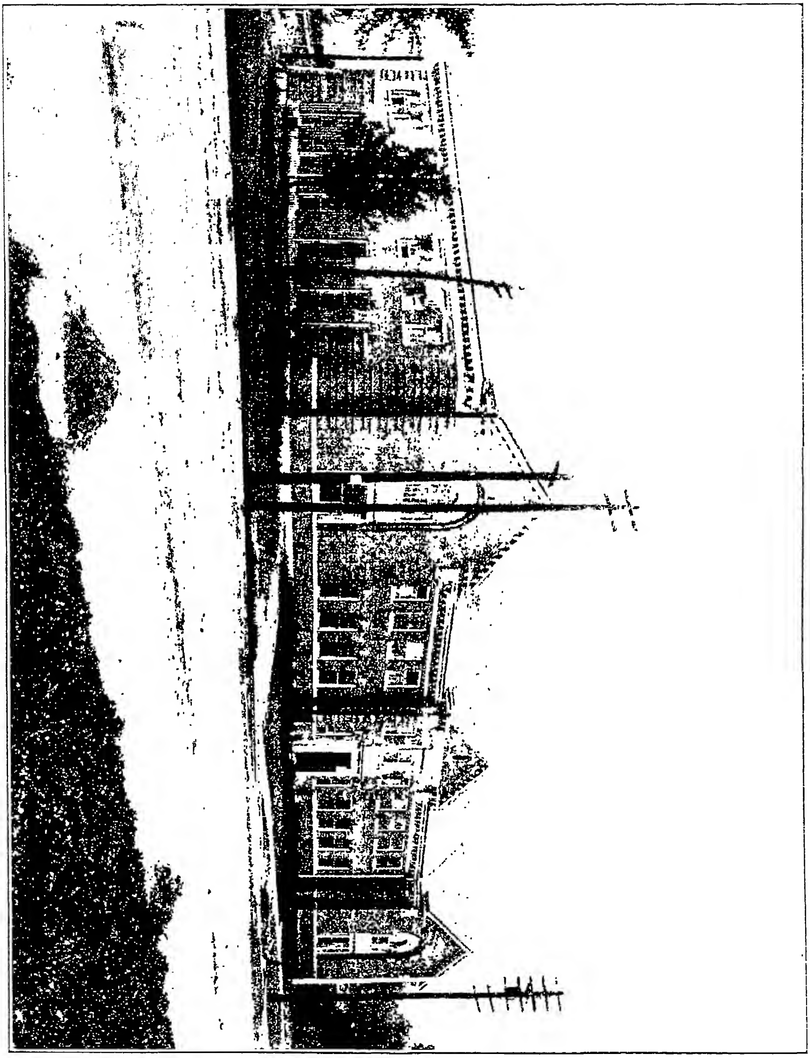
SAVING THE MILL WASTE.

The next point at which it is important to put a check upon wood waste is at the sawmill. In many ways improved methods are beginning to cut down waste at this point. Small articles of trade are being manufactured from material previously lost, or the waste is being turned into valuable products through chemical processes.

Much waste of good material has resulted from the inability of lumbermen to market short or odd lengths of boards. In the past it has been impossible to buy, in the lumber yards, boards or timbers less than 10 feet long or pieces of odd lengths, such as 11, 13, and 15 feet. Timbers that would make boards less than 10 feet long have been thrown away unless they could be worked into lath or other small forms, and pieces that would readily make odd lengths without loss were cut down to even lengths. On the Pacific Coast, where the Forest Service has investigated this practice, it found the loss due to the nonmanufacture of odd lengths in planing-mill material to be 2.7 per cent of the material which passed through the machines. For Washington and Oregon this means 15,000,000 feet of the highest grade of material each year. In the southern pine region the percentage of loss is smaller than in the West, but the total waste on this account is probably not less than 30,000,000 feet. It is the demand of custom. Rather than buy 4-foot boards the American citizen prefers to get a 12 or 16 foot board and saw it into 4-foot lengths. We should also recognize the necessity for short-length boards. Two or three feet should be the minimum length of boards instead of 10 feet.

There is perhaps even greater waste because we do not utilize odd widths of boards. A section of a log which would make a board 7 inches wide is sawed down to 6 inches, and so far little use has been found for the strip which is cut off.

Again, waste results from lack of knowledge of the properties of woods. There was a time when a lumberman went through the hardwood forests and cut only the walnut and the cherry. All other kinds were left as useless to mature and die. Later he took the poplar and the best oak and left the rest. Even now, as valuable as we consider wood to be, the lumberman in some sections leaves



FOREST PRODUCTS LABORATORY, MADISON, WIS., THE PURPOSE OF WHICH IS TO SAVE THE WOOD NOW WASTED IN CONVERTING THE TREE INTO MANUFACTURED PRODUCTS.

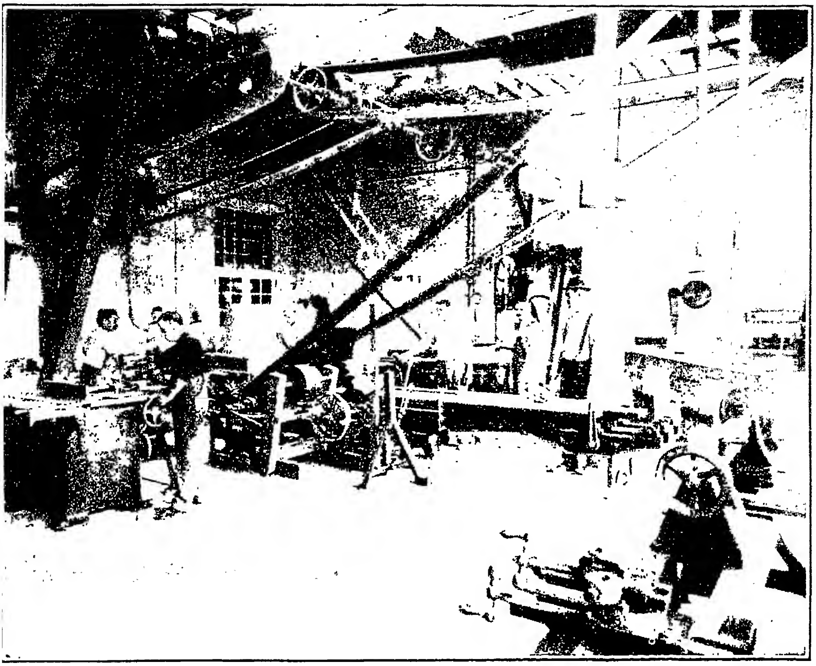


FIG. 1.—PART OF THE EQUIPMENT IN THE WOOD-WORKING ROOM.
[The fine work of preparing specimens for test is done in this room and requires a complete set of high-grade wood-working machines.]

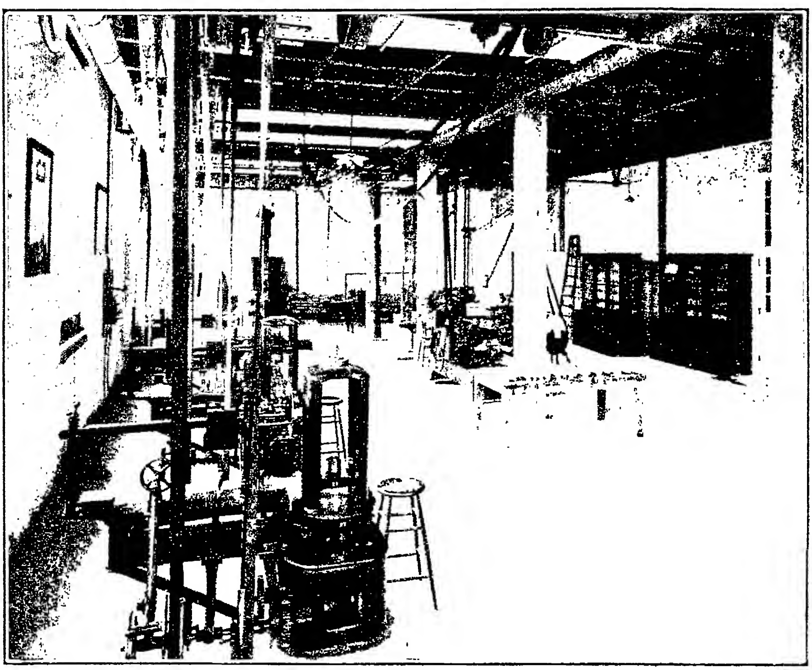


FIG. 2.—TIMBER-TESTING LABORATORY, SHOWING THE SMALL TESTING MACHINES.
[It is necessary to test pieces varying from very small size to beams 8″ x 16″ and 16′ long.]

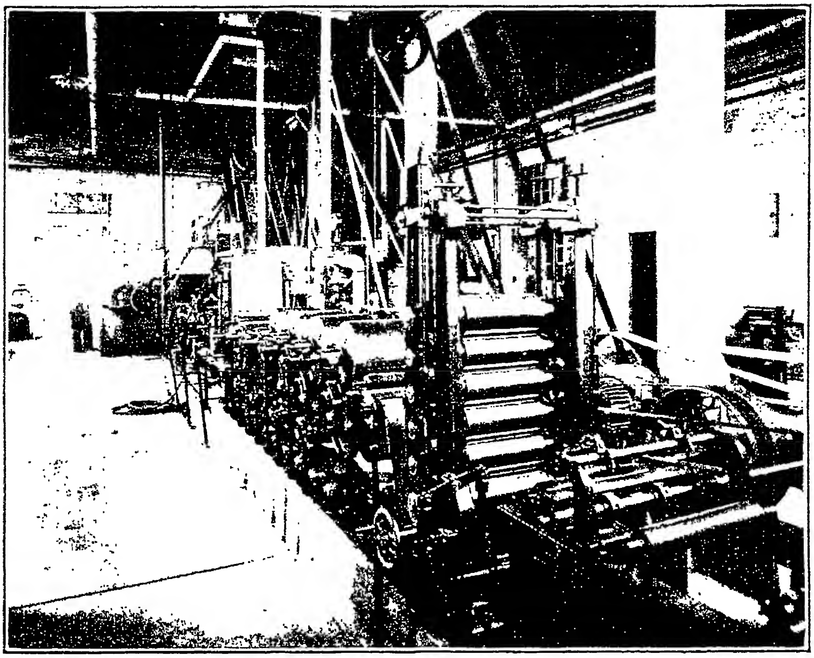


FIG. 1.—PULP AND PAPER LABORATORY, SHOWING FOURDRINIER PAPER MACHINE AND PULP EQUIPMENT.

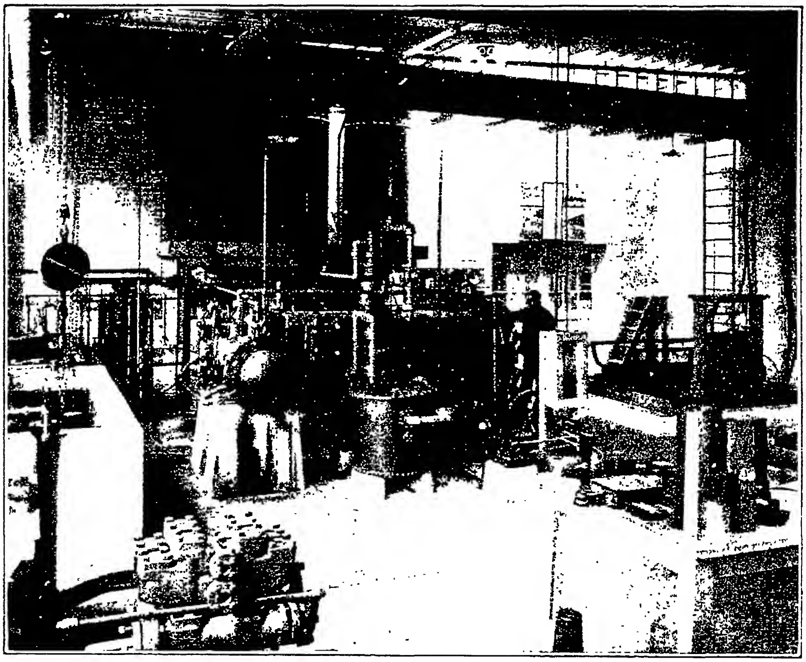


FIG. 2.—TREATING CYLINDERS, PUMPS, AND TANKS IN THE WOOD-PRESERVATION LABORATORY.

[Important experiments are now in progress, which have for their object the improvement of processes of treating wood to prevent its destruction by decay and marine borers.]

in the woods to burn or decay a number of excellent species which ought to yield valuable lumber for our markets.

It is worth while to pursue this point one step further to note that loss is sustained because of our imperfect knowledge concerning the profitable production of the valuable chemical materials that can be obtained from wood. We know, for example, that we can obtain a large proportion of turpentine from certain forms of pine wood. If turpentine could generally be produced at a profit from southern pine mill waste, the quantity of such waste in the southern States is sufficient to produce a quantity of turpentine equal to that now obtained by tapping the live trees. A beginning along this line has already been made. About 30 distillation plants are operating on pine waste in the southern States and in 1907 had an output valued at half a million dollars.

Turning to another phase of the problem, the waste of beech, birch, and maple in the northern woods is sufficient, if it could be properly utilized, to produce most of the wood alcohol and acetate of lime used in this country. If so used it would yield a product worth annually about $7,000,000. Most of the wood now used in the manufacture of these products is cut especially for the purpose. However, sawmill waste to the extent of 60,000 cords, or 5 per cent of the total, was reported in 1907 as used for this purpose, and the amount appears to be increasing each year.

At the present time spruce, hemlock, poplar, and cottonwood are the woods chiefly used for paper making. If the slabs, edgings, trimmings, and shavings from the spruce, hemlock, poplar, and cottonwood cut for lumber in 1907 had been used for paper making, they would have furnished over 4,000,000 cords, an amount amply sufficient to make all the paper manufactured in the United States. The utilization of waste wood for pulp and paper manufacture has possibilities in spite of the fact that obstacles will have to be overcome. Waste wood is not in lengths and widths acceptable to pulp makers, and trouble is met in reducing it to a fibrous condition. Knots, bark, rotten wood, and dirt necessitate extra expense for handling. Yet in 1908, according to the census report, some 250,000 cords of mill waste were used, and the quantity appears to be increasing annually.

READJUSTMENT OF WOOD-USING INDUSTRIES NECESSARY.

The foregoing considerations point to the conclusion that the principal cause of the great waste of wood in the course of manufacture is the lack of proper organization and cooperation among the wood-using industries. The lumberman wants to make lumber and nothing else; consequently, much of his raw material is wasted. The cooperage manufacturer wants to make staves and nothing

else, and demands for his purpose the whole tree when he might use waste from the sawmill. Better adjustment would make it possible for the industry which makes small products to use as its raw material the waste of another which makes only large products. For example, consider the meat skewer. Custom decrees that it be made of hickory. In its manufacture, trees are cut down and sawed into pieces several feet long, from which the skewers are made. This is a wasteful procedure, and hickory is becoming scarce. Skewers should be made from the waste wood of other industries which require hickory in larger pieces.

An example of two industries which would profit by a closer interdependence than prevails at present may be found in lumber manufacture and slack cooperage production. In the past they have been independent, each going to the forest and cutting down the trees needed, handling them by its own processes, and manufacturing its products without regard to the other. In lumber manufacture, the trees are cut into long timbers or boards with a total waste of about 67 per cent of the tree. In cooperage manufacture, the trees are cut into small pieces of a length suitable for making barrel staves, heads, and hoops, with a waste of about 87 per cent. Why should not the barrel staves, heads, and hoops be made from the 67 per cent of waste in the lumber business? There is no adequate reason why this should not be done. Slack cooperage could be produced from exactly the kind of material which is wasted by thousands of feet in most of the large lumber operations. A large proportion of the tops and crooked logs left in the woods, some of the material that goes to the burner, and much more that is fed as fuel to the boiler would be excellent for slack cooperage purposes. Moreover, the two industries employ to a large extent the same woods and are centered in the same regions. It is clear that for the saving of needless waste these two industries ought to be combined, so that the barrel staves of the country might be made from the lumber waste. The census reports show that this combination is slowly being accomplished, but the wonder is that it has not been done before, and the need is that it should come about without delay.

This is only one example. Many others exist. The important thing is that the lumber industry should not continue simply cutting logs into boards. It should diversify its products. Some of the large sawmills might profitably add box factories, as has already been done in a few instances. Others should put in pulp mills, cooperage plants, preservative treatment plants, turpentine or tannic-acid works. Still others will find it profitable to introduce handle or woodenware works. By working such auxiliary establishments the lumber industry will make a profit out of what is now but waste and the public will observe a great cutting down of the waste wood.

Reduction of the waste which takes place in the forest must inevitably follow the reduction of waste at the mill. The operation of pulp mills, treating plants, and distillation retorts in connection with sawmills will give a threefold advantage. It will cut down the quantity of low-grade lumber now turned out, of which there is always an oversupply; it will practically eliminate waste at the sawmill and put out of business the "burner," at whose vanquishment the American people can well utter a sigh of relief, and it will draw out of the forest good wood that is now left there to rot.

WHERE THE RESPONSIBILITY RESTS.

When we consider the waste incident to the manufacture of forest products we are apt to charge this condition entirely to the lumberman and to hold him responsible for its correction. While some individual lumbermen have been flagrant offenders, it is hardly true that lumbermen as a class are to be blamed for wasting the forest. As a rule, they bring out of the forest and sell all the material they can handle without loss. Before the financial disturbance of 1907, when lumber prices had reached their highest point in our history, the lumbermen were cleaning up the ground fairly well. It paid them to take out the low-grade material. A few months later, when the market had gone to pieces, conservative sawmill men estimated that there was being left in the woods from 25 to 50 per cent more than when prices were good. The principle invariably holds that high lumber prices mean less waste, while low lumber prices mean more waste. The lumberman must leave in the woods or burn at the mill that which he can not sell for at least the cost of manufacture.

If we insist on conservation of the timber supply, then the public, the lumbermen and the wood-consuming industries, and the National Government must cooperate in bringing it about and in bearing the expense. The public, as its share in the cooperation, must expect to pay fair prices for lumber. Forest conservation could never be possible with the low prices which prevailed in former days. Something can be done in some parts of the country under the present prices, but in general lumber prices will have to go somewhat higher than they are now before much can be done toward reducing waste in the forest. Another thing which the public must be prepared to do is to accept new kinds of wood and new forms of manufacture. The farmer must give up the use of cedar, white oak, and chestnut posts and be content to use willow, cottonwood, and pine, creosoted to make them durable; railroads must cease using white-oak ties and turn to treated pine and other fast-grown woods; builders must be prepared to accept short lengths of lumber, such as 2 and 4 feet; also odd lengths like 7, 9, and 13 feet, and even odd widths like 5, 7, and 9 inches.

The lumbermen as their part of the cooperation must go ahead in a true spirit of investigation and advancement to work out by every practical means the reduction of that waste which now threatens the permanence of their industry and beclouds its standing before the bar of public opinion. They can do this by increasing the variety of their products. through the operation of by-product plants in connection with their sawmills. Advancement is to be expected and is beginning along these and similar lines. What has actually been accomplished is perhaps less encouraging than the spirit which has come to prevail among those who have to do with the utilization of the forests. At every lumbermen's meeting the cutting down of waste is a subject of consuming interest. The lumbermen realize that the time is at hand for progress along lines of close utilization and the next few years ought to bring material improvement.

A third party in the cooperation is the National Government. Its part is, by investigation of the fundamental problems involved, to discover methods by which forest waste may be abated. Many difficult problems are to be solved. If they were not difficult they would have been solved long ago. But they are not impossible of solution and the Government can better undertake them than the lumberman, because many of them call for fundamental scientific work which lumbermen are not prepared to do. The Government has already started upon this work. In cooperation with the University of Wisconsin it has established at Madison, Wis., a thoroughly equipped wood-testing laboratory which was formally opened on June 4, 1910, in the presence of nearly 500 visitors representing various lumber and wood-using associations. A mass of work awaits the attention of the laboratory in the problems of the economic use of the forest and its products. Many of these problems are highly complex and can not be solved without the most thorough investigation. At the same time they are broadly commercial, and the results obtained can not be applied without a complete knowledge of commercial conditions among the industries which utilize wood. The laboratory, of necessity, therefore, works in close touch with the forest-dependent industries. (See Plates XVII–XIX.)

It is not too much to expect that with faithful cooperation between the public, the forest-dependent industries, and the Government the important problem of forest utilization with a minimum of waste will ultimately be solved.

PROGRESS AND PRESENT STATUS OF THE GOOD ROADS MOVEMENT IN THE UNITED STATES.

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PERIOD OF COLONIAL EXISTENCE.

When the early settlers first began the colonization of America their settlements were confined largely to the coast and inland waterways, because the water afforded them an avenue of transportation which supplanted for the time the necessity for roads. As the settlements increased and spread over larger areas of territory, however, the necessity for land communication between the various settlements arose, and the need for some form of highway became essential. At first the Indian trails and the paths of wild animals through the forests were used for this purpose, but soon wider roadways were required. The French settlers along the Mississippi River and the Canadian border, together with the Indians, were beginning to contest the westward encroachment of the English colonists from the Atlantic seaboard, and numerous armed conflicts were taking place. Troops, arms, and ammunition had to be moved to the frontier in order to prosecute these wars, and wider roadways had to be provided for their passage. The frontier settlements also demanded a closer communication with the more thickly settled coast colonies, in order that immediate relief might be procured in case of attack from the enemies on the west. Following this necessity for opening up roadways for military purposes, the commerce of the colonies grew to such an extent that better transportation facilities had to be provided. Consequently the colonies early had to turn their attention to the question of road building.

Since most of the colonists were of English descent, it was but natural that the first road laws should be based upon the English precedent. The first of these laws enacted in America was by the Virginia House of Burgesses in 1632 and provided that respect should be had to the course pursued in England. This was followed by other road laws, and in 1662 a stricter law was passed, having for its object the maintenance of highways in good condition. During this year surveyors were appointed whose duty it was to establish a system of highways wherever needed in their districts, as follows: First, a convenient road to the church was to be made, to be followed by the construction of roads to the courthouse, to Jamestown, and,

finally, from county to county. These roads were required to be 40 feet wide. The surveyors in doing this work had the assistance of laborers sent to them by the owners of adjacent estates, who, upon the call of their vestries, were compelled to furnish as many persons for this purpose as they had tithables in their families. Each surveyor was assigned certain work to be performed, and if he showed indifference to the performance of his duties, the county court, upon complaint being offered, instructed the clerk to communicate the fact to the church wardens of the parish through the minister and to command them to enforce the law. There were instances in which private citizens were granted a certain amount of tobacco as compensation for keeping a public road in repair. "In 1670 an annual allowance was made to Mr. Thomas Hunt of one thousand pounds under an arrangement binding him to maintain a good roadbed for highways, foot and cart, over the mill dam at Portam."[1]

Road building in Maryland had its beginning in 1625, but the first road law passed by that colony was in 1666. Under this law overseers were to be appointed who could levy tobacco or labor on the taxables of each county for the purpose of building and working the roads. The roads in Maryland, like those in the other colonies, were little more than tracks through the forests. The New York deputies in 1671 were ordered to open one-half of the road from Newcastle to Bohemia Manor and the other half was to be opened by Maryland. In 1674, Cecil County, Maryland, took up road building, opening among others the old Choptank Road, which had been cleared to a width of 12 feet in 1682. New road laws were passed in 1696 and 1704, and the latter law remained in force for nearly a century.

In the New England colonies the oldest road was the Plymouth or Coast Path, which joined the capitals of the two colonies, Boston and Plymouth. This road was established by the general court by way of old Braintree in 1639. At this time, however, very little attention or interest was being devoted to the subject of road improvement. In 1653 the Massachusetts commissioners established the "Kennebunk Road by the Sea" as a highway "between towns and towns for horse and foot."

The following regulation for road building, which had been in force in Pennsylvania until the beginning of William Penn's administration, was established by the government of the Province of New York in 1664:

In all public works for the safety and defense of the government, or the necessary conveniences of bridges, highways, and common passengers, the governor or deputy governor and council shall send warrants to any justice, and the justices to the constable of the next town, or any other town within that jurisdiction, to send so many laborers and artificers as the warrant shall

[1] Economic History of Virginia in the Seventeenth Century, vol. 2, pp. 523–565.

direct, which the constable and two others or more of the overseers shall forthwith execute, and the constable and overseers shall have power to give such wages as they shall judge the work to deserve, provided that no ordinary laborer shall be compelled to work from home above one week together. No man shall be compelled to do any public work or service unless the press (i. e., impressment) be grounded upon some known law of this government, or an act of the governor and council signifying the necessity thereof, in both which cases a reasonable allowance shall be made.

The highways to be cleared as followeth, viz., the way to be made clear of standing and lying trees, at least 10 feet broad; all stumps and shrubs to be cut close by the ground. The trees marked yearly on both sides—sufficient bridges to be made and kept over all marshy, swampy, and difficult dirty places, and whatever else shall be thought more necessary about the highways aforesaid.

This law was slightly amended in 1678 by an order of the court at Upland, so that every landowner was required to build roads on his land connecting his home with those of his neighbors.

Under the government of William Penn the roads of Pennsylvania were given over to the county courts, which appointed overseers, while the grand jury laid out the roads. Control of the roads, however, was given to the townships in 1692, and in 1700 an act was passed whereby jurisdiction over them vested in the county justices. Just a few years later the New Jersey assembly also took up the question of road legislation.

South Carolina enacted its first road law in 1682, constituting a board of commissioners and fixing a labor tax, but very few roads were built prior to 1730. Roads were built by the French in Alabama as early as 1702. These roads continued to serve as mail and stage lines long after French occupation ceased. In Georgia the first road was built in 1735.

Thus it is apparent that all of the colonies early began to realize the necessity for highways. These various laws were very crude and were productive of very little in the way of accomplishing an improvement of road conditions. They all provided for extremely localized systems of administering their road affairs, depending upon local revenues consisting generally of labor taxes. At least, however, they marked the beginning. At that time scarcely more could be expected from the colonies, because they were in an undeveloped condition and were receiving no aid and but little encouragement from the mother countries. They possessed only small means and were thus forced to be content with crude and inferior highways. Their time, energies, and thoughts were consumed in erecting homes and clearing fields, and in repulsing the assaults of the Indians and resisting the oppressions of the old countries; so that for more than two centuries after colonization began nothing more was attempted in the way of road improvement than to meet the most pressing exigencies and necessities of the times.

EARLY NATIONAL EXISTENCE.

The American Revolution, however, established the independence of the colonies, and political and economic conditions began to assume a brighter aspect. Almost contemporaneous with the inauguration of the Federal Government numerous schemes for internal improvements were projected. The population was increasing rapidly, and the Allegheny Mountains, so long the western boundary of the colonies, no longer held back the tide of immigrants. Settlements sprang up west of the Alleghenies and soon an insistent demand arose for means of communication between the East and West. Commerce was also developing among the various States and the necessity for better transportation facilities was becoming more apparent. Consequently early in the nineteenth century the subject of road building became of paramount importance and a decided movement for better roads was begun.

This movement first manifested itself in the construction of toll roads. Many corporations were chartered for this purpose and many excellent roads were built under this system. A notable instance is what was known as the Wilderness Turnpike, extending from the Shenandoah Valley in Virginia westward by way of the waters of the upper Tennessee and Cumberland Gap to central Kentucky. But the first toll road constructed in North America was the Philadelphia and Lancaster Turnpike, begun in 1792. During the first half of the nineteenth century the building of turnpikes or toll roads was carried on actively throughout all of the States. According to the report of the Secretary of the United States Treasury in 1808, there had been incorporated in the State of New York 67 turnpike companies, with a capital of about $5,000,000, and 900 miles of road had already been completed and 200 miles more were to be completed. This movement grew so rapidly that in 1828 there had been incorporated in the State of Pennsylvania 168 companies for the purpose of building about 3,110 miles of turnpike roads, 2,380 miles of which had already been completed at a cost of nearly $8,500,000.

It was inevitable, however, that the turnpike system should eventually be abandoned. It was impracticable of successful operation, because it was almost impossible to maintain the roads properly and retain a sufficient amount from the tolls collected to meet the dividend requirements on the capital stock invested. . In proof of this, it has been stated that none of the toll roads of Pennsylvania yielded profitable dividends. This toll system, of course, proved very beneficial in the early development of the agricultural and commercial interests of the country, as it resulted in the building of a considerable mileage of improved roads, which could not have been financed in any other way at that time; but with the advent of the railroad as a practical factor

in transportation, about 1832, the building of turnpikes was gradually discontinued. At the present time there are a number of isolated sections of toll roads throughout the country, but these are rapidly being purchased by the States or counties and made free, and it is probable that within a few years there will be no public highways in the United States on which toll charges will be allowed.

There also grew up, immediately after the establishment of the Federal Government, a strong sentiment for a system of National roads, to be built and maintained by the National Government. The advocates of this policy were for a while successful and numerous appropriations from the National Treasury were made by Congress for this purpose. The first appropriation was made in 1806, when a law was enacted providing for the construction of a great National road from Cumberland, Md., to a point which was gradually moved westward to the Mississippi River near St. Louis. This road has become known in history as "the old Cumberland pike." Other appropriations were made from time to time until $7,000,000 in all had been appropriated for this undertaking. Appropriations aggregating about $7,000,000 were also made for other National roads, making a total of about $14,000,000 appropriated by the Federal Government for the construction of highways. The policy of interpreting the Federal Constitution so as to permit these appropriations was not, however, finally abandoned until about 1858, just prior to the Civil War. After the close of the war, the problem of meeting the stupendous National debt engaged the entire attention of Congress and created a drain upon the National revenues, so that the subject of National participation in road improvement dropped out of the public mind.

FROM 1860 TO 1890.

Road conditions in the United States suffered a severe setback as a result of the Civil War. The National Government definitely ceased its participation in this form of public improvement; the turnpike companies for most part passed out of existence; and the States were giving neither aid nor attention to the subject. Local revenues, mostly in the form of statute labor, were depended upon entirely for the construction and maintenance of the roads, and the old system of extreme localization was revived, with the administration of road affairs left to the towns in the North and East, and to the counties in the South and West. During this period many miles of new roads were laid out, but so little attention was given to actual improvement that a road census, made in 1904 by the Office of Public Roads, revealed the fact that there were 2,151,000 miles of public roads in the United States of which only 7.14 per cent were improved.

This census also showed that the total annual expenditure for roads in the year 1904 was $79,000,000, or an average of about $37 per mile, and of this amount $19,000,000 was represented by the wholly inefficient statute or forced labor, which, in fact, reduces the cash expenditure for that year to an average of about $27 per mile. This entire fund was administered under the system of localized control so long in vogue throughout the country, and it was largely due to this system that so little in the way of good results was accomplished, for the reason that it fails to insure skilled supervision, provides an inadequate revenue, depends upon a purely unskilled and unreliable class of labor, and practically precludes any construction of a permanent character.

STATE AID.

For some time, however, public sentiment throughout the country had been growing in favor of a reform in this old system of administration. This sentiment first found tangible expression in a law passed by the New Jersey Legislature in 1891, providing for an annual appropriation of $75,000 from the State treasury. This law provided for local initiative and for local surveys, estimates, and supervision, while the State was given the right to accept or reject the petition for State aid and to accept or reject contracts for construction. It also provided that, upon petition, addressed to the board of freeholders of the county, by two-thirds of the property holders along at least one mile of road, pledging themselves to pay 10 per cent of the cost of improving such road and requesting State aid, application could be made to the State Board of Agriculture for aid to the extent of 33⅓ per cent of the total cost of improvement, while the county was to bear the remaining 56⅔ per cent of the cost and maintain the road.

While this law gave very little authority to the State, still it was along the right lines, and the ultimate result was sure to be a vesting of greater control in the State and an increase in its annual appropriations. The first important change in the law was made in 1894, when the work was taken from the State Board of Agriculture and placed in the hands of a commissioner of public roads, to be appointed by the governor for a term of three years. The control of the work is still largely in the hands of local officials, but the power of the State highway department to accept or reject petitions and contracts has a most beneficial effect in preventing useless construction and in requiring the work to be done in accordance with proper methods. The State appropriations have gradually been increased each year until the amount available from that source for State aid in road building in 1910 was about $500,000, consisting of $300,000 direct appropriation and about $200,000 derived from the automobile tax.

Following closely the example of New Jersey, Massachusetts in 1892, Connecticut in 1895, and New York in 1898, established State highway departments with State aid, or took steps looking to that end. New York State affords a striking instance of development from a purely local to a highly centralized system. Prior to 1898, extreme localization in the administration of road affairs prevailed. During that year, however, two laws were enacted by the State legislature, one of them known as the "Fuller-Plank" or money system act, and the other known as the "Higbie-Armstrong" or highway improvement act. The "Fuller-Plank" act had for its object the maintenance of the public roads of the State, and provided that towns adopting a system of cash road taxes in lieu of the old labor tax could receive from the State 25 cents for each dollar of taxes so levied and collected. This law was amended in 1902 to allow the amount which was to be paid by the State to be increased to 50 cents on each dollar so raised locally. This was a powerful incentive to the abolition of statute labor and to the raising of cash road revenues, as can be seen from the fact that the annual amount paid out by the State treasury under the act increased from $34,517 in 1899 to $1,057,605 in 1908.

The gradual improvement of a system of stone-surfaced roads throughout the State, connecting the county seats and the cities and larger villages, was contemplated by the "Higbie-Armstrong" act. Under this act the State was to pay 50 per cent, the county 35 per cent, and the town 15 per cent of the cost of stone-surfaced roads to be built in accordance with its provisions. Petition for this aid had to originate with the county board of supervisors, upon receipt of which and in accordance wherewith the State engineer and surveyor was required to prepare plans, specifications, and estimates of cost and, if approved by the county board of supervisors and local funds were available, contract was awarded and supervision of the work undertaken by the State engineer. Roads improved under this act were to be maintained by the towns, under directions from the State engineer and surveyor. The appropriation made with the passage of the act was $50,000, which was increased from year to year. In addition to this the State legislature adopted a resolution in 1905 proposing an amendment to the State constitution authorizing an issue of $50,000,000 in State bonds for road purposes. This resolution was ratified at the general election in November, 1905, and in May, 1906, an act was passed providing for issuance of the proposed bonds.

In 1907 the New York legislature adopted a further plan whereby the county pays 2 per cent of the total cost of roads for each $1,000 of assessed valuation per mile in such county, and the town pays 1 per cent for each $1,000 of assessed valuation for each mile in such town. During this same year, also, a committee was appointed to

undertake a revision of the highway laws of the State, and upon its recommendation the road laws of the State were amended and consolidated. The present law, which became effective January 1, 1909, is the result. Under this new law a State highway commission, consisting of three members, was provided for, together with a system of about 2,800 miles of State roads, to be improved and maintained solely at the expense of the State.

The county roads are to be improved jointly by the State, the county, and the towns; the county is to pay 2 per cent of the total cost of such improvements for each $1,000 of assessed real and personal property liable to taxation in such county for each mile of public highway therein, and the town is to pay 1 per cent of such total cost for $1,000 of assessed real and personal property liable to taxation in such town for each mile of public highway therein, but not exceeding 35 per cent of the cost shall be paid by the county or 15 per cent by the town or towns. The town highways are to be improved and maintained by the towns with funds locally raised and supplemented by the State aid apportionment, which is to amount to from one-third to one-half of the entire cost according to the assessed valuation of real and personal property for each mile of highways in the town. The proportion paid by the State is to vary inversely with the assessed valuation.

Under this new law the State highway commission has supervision, either directly or indirectly, over every mile of public highway in the State. For administration of its road affairs, the State is divided into six divisions, with an engineer in charge of each division; his duties are confined to improving and maintaining the State and county roads therein which have no connection with the town highways. While the funds for the town highways are expended locally, still they are under the supervisory direction of an official of the State highway department. Improvement of State and county highways is carried on wholly by contract. Plans, specifications, and estimates are prepared by the State highway commission, and, in the case of county roads, are submitted to the board of supervisors of each county involved for final approval. The State highway commission is given the power to accept or reject the improvement when finally completed. The first deputy of the commission has the direction of the maintenance of State and county roads.

Other States have adopted the plan of State aid and State supervision in some form, among which are Arizona, California, Colorado, Connecticut, Delaware, Florida, Georgia, Idaho, Iowa, Illinois, Kansas, Louisiana, Maine, Massachusetts, Maryland, Michigan, Minnesota, Missouri, New Hampshire, New Mexico, North Carolina, North Dakota, Ohio, Pennsylvania, Rhode Island, Utah, Vermont, Virginia, Washington, West Virginia, and Wisconsin. Some few of these have

only State departments for investigation and supervision, others furnish State aid only in the form of convict labor, while most of them furnish State money aid with State supervision.

Among those having State highway departments for investigation and supervision are Iowa, Kansas, Missouri, North Carolina, and Wisconsin. In these States the State highway organization is maintained for the purpose of giving advice to local officials upon any phase of the road question which may arise in any locality throughout the State, but no money aid of any kind is expended in the actual work of improvement. When counties or their local communities undertake improvements, the State highway department furnishes an engineer to supervise the work.

The State of Illinois, in addition to the investigative and supervisory work of the State highway department, extends its aid in the actual work on road improvement by maintaining a crushing plant. It operates it by the use of State convicts and distributes crushed rock for road-building purposes to the various counties throughout the State on application of the county officials. No charge is made for crushing this rock and placing it on board the cars at the crushing plants, but the freight charges have to be paid by the county. The State highway commission, however, makes agreements with the railroad companies concerning what freight rates shall be charged; and, consequently, the counties obtain this prepared material at the lowest possible rate of freight that can be secured.

The State of West Virginia in 1909 passed a law making a direct appropriation from the treasury for the construction of State-aid roads and also placing both the State and county convicts at work upon its highways. Virginia also provides convict labor, and makes an annual appropriation of $250,000.

Arizona, Colorado, and New Mexico extend aid by the use of convict labor, and also by appropriations from either the State or Territorial treasury for the construction of certain specified State or Territorial roads. The States furnishing only convict labor are Florida, Georgia, Louisiana, and North Dakota. In this form of aid Georgia probably takes the lead of any State in the Union. Both State and county convicts are worked upon the roads each day in the year, and a force of about 4,500 convicts is working a wonderful reformation in road conditions throughout that State.

The States taking the lead in the work of road improvement are devoting considerable attention to the construction of trunk-line roads. This is a very wise move on the part of these States, because any money expended by a State on road construction should be in pursuance of a plan looking to the ultimate establishment of a connected system of State roads. This can not be as easily and success-

fully attained by any other method as by the adoption of the trunk-line system. Among the States adopting this plan of improvement are Maryland, which is to expend $1,000,000 for trunk-line roads in 1910, New Hampshire to spend $430,000, New York to spend $2,500,000, and Washington to spend $620,000, while at the recent election a law was ratified in California providing for the issuance of $18,000,000 in bonds for the construction of a system of trunk-line roads throughout that State.

PRESENT TREND.

The present trend of road affairs throughout the various States is toward a reform in administration and the adoption of a more progressive policy. The old system of paying road taxes in labor has proved inefficient and is being rapidly discarded for the better plan of requiring all road taxes to be paid in cash. It is also apparent that the State will ultimately be the unit of administration and will largely control and direct road work in the counties and townships. A reduction in the number of road officials is also inevitable, and knowledge and skill in road building will be required of each official. The necessity for skilled supervision is being recognized in every State, and is being met by the appointment of competent highway engineers. In many States the State highway departments employ a corps of highway engineers, and different counties throughout these States also employ county highway engineers, while in many of the States not having State highway departments the counties are engaging the services of skilled engineers to supervise their road work. This step marks one of the greatest strides yet made toward the abandonment of old and inferior methods of highway administration, construction, and maintenance. All of these reforms, as well as other reforms in methods of construction and maintenance and a gradual improvement of road conditions, are being rapidly brought about, and largely through the agitation and work of the United States Office of Public Roads, the State highway departments, and the various highway associations throughout the country.

During the year 1911 the legislatures of 42 States will be in session, and the outlook for road legislation is exceedingly bright. Already members of the legislatures of various States and of various organizations, having for their purpose the improvement of highway conditions throughout the country, are formulating highway bills with the hope of having them enacted into law. In every State the sentiment is strongly in favor of effective highway legislation, and in most of the States not having already adopted it new legislation, either enacted or pressed for enactment, will embrace in some form or other the principle of State aid or State supervision.

THE GRADING OF CREAM.

By B. D. White,

In charge of Dairy Manufacturing Investigations, Dairy Division, Bureau of Animal Industry.

INTRODUCTION.

There seems to be great need for a change in the methods of paying for cream at many creameries, because competition has driven the creamery men into accepting cream regardless of quality, age, or condition. The methods used in the past and the changes which have taken place in the last two decades are responsible for the deplorable condition under which a large percentage of the cream is being delivered to the creameries in some States at the present time.

Previous to the introduction of the centrifugal separator most creameries were operated on either the gathered-cream or the whole-milk Cooley system.

Under the gathered-cream plan, which was the one generally adopted, the milk was "set" in receptacles, usually tin pans or earthen crocks, and the cream allowed to rise. This was skimmed off and held for the arrival of the cream hauler, who was usually an employee of the creamery. In most cases routes were arranged so that the collector started from the creamery in the morning, collecting cream from farmers along one road, and returned another way, arriving at the creamery in the evening with the collection of the day. Collections were made once or twice a week, and enough routes were established to employ all the time of the collector.

This plan was not satisfactory from the standpoint of quality, as the cream in summer always arrived sour, while in the winter months it was usually frozen, especially in the North; and in all seasons it contained the various odors and flavors absorbed from the kitchen, pantry, or cellar. Creameries of those times were not operated on a sound business basis. The system was unsatisfactory to the farmer because of the low price he received for his cream, and the creamery man and the consumer suffered because of the poor quality of butter, which was usually sour or stale and soon became rancid. In those days many people refused to buy creamery butter because the name "creamery" conveyed to them the idea of poor quality and an

undesirable product. Dairy butter was sought and generally preferred to that made in a creamery.

In 1879 the power cream separator was introduced and was soon extensively used. This put the creamery business on a new basis. The farmers delivered daily to the creamery the fresh sweet whole milk, from which the cream was at once separated by power, and the cream, after being properly cooled, was churned into butter that was usually of fine quality. The latter system returned much more money to the farmers than the former; consequently no objection was made by them to hauling the milk to the creamery every day. To this new system is perhaps due the large increase in the number of creameries built from 1885 to 1905, during which time approximately 5,000 creameries were established in this country. The attitude of the consumers toward creamery butter was soon changed from prejudice to praise, and this product gradually grew in favor until it became the standard of the United States.

It is a fact to be regretted that there has again been a deterioration in the quality of some creamery butter, which deterioration can be traced, perhaps, to the introduction of the hand separator. Where the hand-separator system has been adopted the cream is separated from the milk at the farm, only the cream being taken to the creamery. Other things being equal, this cream is of as good quality as the cream from a power separator at the creamery; but unfortunately many hand separators do not receive proper care, and the cream, instead of being cooled and churned at once, is often kept from 3 to 10 days on the farm without any cooling and is allowed to stand where foreign odors and flavors are absorbed. Much of the cream handled in this way is sour and tainted, and only poor grades of butter can be churned from it. The cause of poor creamery butter can usually be traced to the poor cream received.

From information obtained at the principal butter markets it appears that only 7 to 10 per cent of the butter received grades "extras," and the other 90 to 93 per cent must be classed as firsts, seconds, and thirds. Of these grades the last two are not considered of high enough quality to satisfy the taste of the average consumer.

In many creameries there has been no incentive for the farmer to deliver good cream, as the price he received was the same for sour, stale, and putrid cream as for perfectly sweet cream delivered daily. In some localities, however, creameries have recognized the demoralizing effect that such a practice has on their business and many of them have instituted a plan for paying on the basis of quality, with the result that much improvement has taken place in the quality of the raw material received. This has caused a much better grade of

butter to be made, and has resulted in a material increase in the price paid to the farmers for their cream.

COMPARISON OF PRICES OF SWEET AND SOUR CREAM IN 1909.

A compilation has been made of the prices paid to creamery patrons in 1909 for butter fat and the price received for the butter in the two classes of creameries—those receiving sweet cream and those receiving sour cream.

Prices paid for sour and sweet cream and prices received for butter at creameries in Minnesota, Wisconsin, and Iowa in 1909.

State.	Kind of cream.	Number of creameries reporting.	Price paid for butter fat.	Price received for butter.
			Cents.	*Cents.*
Minnesota	Sweet cream	54	31.35	28.57
Do	Sour cream	158	28.81	27.50
Wisconsin	Sweet cream	12	30.83	28.18
Do	Sour cream	48	30.44	27.94
Iowa	Sweet cream	9	31.62	29.45
Do.	Sour cream	27	29.58	27.98
Average of 3 States	Sweet cream	75	31.30	28.61
Do	Sour cream	233	29.23	27.63
Difference in favor of sweet cream			2.07	0.98

It will be seen that the difference in price paid to patrons by the creameries is 2.07 cents per pound of butter fat in favor of the creameries receiving sweet cream, or whole milk. This amount is more than sufficient to pay for the expense of hauling the cream from the farmer's door to the creamery.

In 1909 the three States named produced approximately 300,000,000 pounds of creamery butter. Of the 308 creameries reporting on this investigation 75.7 per cent received sour cream and the butter sold for 0.98 cent less than the butter from those creameries receiving sweet cream. If the ratio between sweet and sour cream be applied to the total production of these States it indicates a loss of $2,225,580, at 0.98 cent per pound, but since 1909 there has been a wider range of the prices in the various grades of butter. If butter is sold on grade, the difference, instead of being 0.98 cent per pound, would be about 6 cents, and the loss would be near $10,000,000, as the difference in price of creamery butter between the highest and lowest grades has increased in the last year, and there is now a variation of 6 cents per pound between the grades of specials and seconds.

Of the 71,591 packages (or 4,438,642 pounds) of creamery butter examined on the markets of New York and Chicago in eight months

of 1910 by representatives of this Department, 44.2 per cent graded seconds and below, practically all due to the use of poor cream.

The power to raise the quality of creamery butter lies in the hands of the farmers, especially those who are patrons and shareholders of cooperative creameries, but it will require the combined effort of all the patrons to accomplish the desired results.

EDUCATION OF THE FARMER.

It has been urged that inspectors should be sent through the country to instruct the farmers in the care of milk and cream. This, however, would involve much expense and would likely result in but little good. Through the dairy districts, such as Iowa, Minnesota, Wisconsin, Illinois, Michigan, Ohio, etc., the farmers a few years ago delivered to the creameries clean, sweet milk, which was made into a first grade of butter that brought the highest price. Many of the same farmers are to-day delivering cream a week old. This is not done because of lack of knowledge, but because their cream, bad as it is, is accepted by the creamery. If one creamery does not accept it another will; the farmer, therefore, is simply following the line of least resistance.

PAYING FOR QUALITY.

If the creamery men would pay for cream according to its true value there would be a rapid improvement in the quality. The proportion of good table butter that would grade "extras" would probably reach 90 per cent instead of 7 to 10 per cent, as is now the case. This assumption is justified by the results obtained from the introduction of the grading system in the State of Maine. The dairy authorities in that State inform us that at one time at least 90 per cent of the cream was sour when it reached the creameries, but that within a short time after a system of grading was established by which sweet cream received a premium of 2 to 3 cents per pound of butter fat, 95 per cent of the cream was sweet when it reached the creamery, and this condition still prevails. This simple system of grading has proved to be of mutual advantage to the creameries and their patrons in this section. The latter have received a price for their product several cents above market quotations, while the creameries have maintained a high standard for their finished product.

An investigation of the conditions in Maine has brought out the fact that the farmers are delivering their cream only two or three times a week during the summer months, but, as stated above, 95 per cent is sweet when it reaches the creamery. In fact, a large amount of this cream is used to supply the sweet-cream trade in the cities, and is from 4 to 7 days old when consumed. The secret by

which the Maine farmer keeps the cream sweet lies in the fact that the milk or cream is cooled immediately by being placed in ice water. The result of doing this is generally understood but not often practiced, except on compulsion or when made remunerative to the producer.

BASIS FOR GRADING.

The plan that seems to have been most successful in operation is to make two grades of cream, No. 1 and No. 2.

No. 1 cream must be sweet, with a clean flavor, and for it a premium of from 1 to 3 cents a pound of butter fat is paid.

No. 2 cream may be sour, but must have a clean flavor, and for this grade a straight price based on quotations is usually paid.

Cream that is not clean in flavor and consequently not included in either of these grades is rejected. Good butter can not be made from such cream, and it is not profitable to either the producer or the manufacturer at any price.

The butter-fat content of cream is usually given some weight in grading, as it is desirable that cream may be of the proper consistency for churning without requiring either dilution or concentration. When cream is received at the creamery it is carefully inspected, the two grades being weighed, ripened, churned, and marketed separately. The butter made from the No. 2 cream will usually bring the quotation price, while the butter from the sweet cream, if properly made, will bring a premium over quotations. In this way the creamery can afford to pay its patrons a higher price for fresh, untainted raw material, and so the farmer gets some substantial reward for the care he has exercised. The consumer is always satisfied to pay an extra price for a clean and wholesome product handled under sanitary conditions.

ICE HOUSES AND THE USE OF ICE.

The storage of ice can be made profitable in many parts of the country by using it to keep milk and cream in better condition. Wherever the natural product can be secured the cost of storing is so small that no one need be without ice on this account.

On the basis of a 20-cow dairy it requires about 500 pounds of ice to cool the cream annually produced by one cow. To this amount should be added 500 pounds more for waste, or a total of 1,000 pounds a year for each cow. This amount is sufficient to keep the cream sweet and in good condition, so that for a herd of 20 cows 10 tons of ice would be required. In smaller dairies the waste would be greater and proportionately more ice would be required, while with larger ones a proportionately less amount would suffice.

There are approximately 50 cubic feet of stored ice to the ton, consequently for 10 tons it would be necessary to fill a space 10 by 10 by 5 feet. An ice house for this quantity should be built 12 by 12 by 8 feet, which would allow for 12 inches of sawdust on the sides (sufficient to keep ice under ordinary conditions) and enough space on the top for packing and covering the ice.

From the investigation made of ice houses in Maine, where farmers generally store ice, it appears that only a few or them are built of new lumber. In most cases old lumber, or a discarded building such as an old granary, corn crib, or shed, was used; in fact, any building that will hold sawdust may be used for an ice house. The amount of new lumber required for an ice house holding 10 tons of ice would be about 1,800 feet.

In building a new ice house, or using an old building for that purpose, care should be taken to provide good drainage. The ice should be packed on about 12 inches of sawdust, or if sawdust is expensive, chopped prairie hay or even oat or barley straw that has been well broken in thrashing may be used in place of sawdust. Soft-wood sawdust is better than that from hard wood.

In a small ice house there should be about 12 inches of sawdust between the ice and the walls of the house. Ample ventilation should be provided. The most efficient probably is an opening of a few inches under the eaves. This will allow free circulation of air, but will not permit the rays of the sun to shine on either the sawdust or the ice. The sawdust should be kept well packed on the sides and evenly distributed over the top surface of the ice. Sawdust will keep ice much better when dry than when wet.

INSECT ENEMIES OF TOBACCO IN THE UNITED STATES.

By A. C. Morgan,
Agent and Expert, Bureau of Entomology.

INTRODUCTION.

In 1898 Dr. L. O. Howard published an article dealing with insect enemies of tobacco in the United States. Since that time some new pests have appeared and much additional information has been obtained regarding others. The present article is designed, in a measure, to be supplementary to that by Doctor Howard.

More extended papers upon some of these pests will appear later in the publications of the Bureau of Entomology.

For convenience of treatment, the insects described in this article are divided into two classes, (1) insects of primary importance; (2) insects of secondary importance.

LOSS CAUSED BY TOBACCO INSECTS.

In 1907 the tobacco flea-beetle was exceptionally injurious in Kentucky and Tennessee and caused a loss of approximately $2,000,000. In Florida, in 1908, the tobacco splitworm caused a loss of $12,000 upon one plantation, an average of $150 per acre. The tobacco thrips injures wrapper tobacco seriously in Florida every year, frequently necessitating a regrading of from 10 per cent to 20 per cent of the crop and a consequent reduction in value of from 50 cents to $1.20 per pound. In years of severity the cost of fighting this pest may be as high as $20 per acre. The tobacco budworms have to be fought constantly in the shade-tobacco districts in Georgia and Florida. Although very little tobacco is ruined by these pests, it is estimated that the cost of fighting them ranges from $12 to $15 per acre, a tax of from $60,000 to $75,000 upon the growers for the 5,000 acres of shade tobacco. Tobacco hornworms are found in all tobacco fields and are the most serious pests of the industry. Their injuries vary from 2 per cent to 3 per cent in localities where they are scarce, and from 10 per cent to 15 per cent in localities where they are plentiful. The cigarette beetle,

which infests cured and manufactured tobaccos, also levies a yearly toll of many thousands of dollars upon the tobacco industry. The total yearly loss to the tobacco industry from insect pests probably never falls below 5 per cent—a monetary loss of approximately $5,000,000, and it may be as high as 8 per cent to 10 per cent, entailing a loss of from $8,000,000 to $10,000,000.

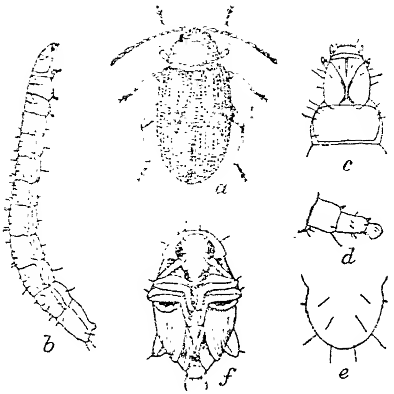

FIG. 3.—The tobacco flea-beetle (*Epitrix parvula*) : *a*, Adult beetle ; *b*, larva, side view ; *c*, head of larva ; *d*, hind leg of same ; *e*, anal segment of same ; *f*, pupa. *a*, *b*, *f*, Enlarged about 15 times ; *c*, *d*, *e*, more enlarged. (From Chittenden.)

INSECTS OF PRIMARY IMPORTANCE.

THE TOBACCO FLEA-BEETLE.

(*Epitrix parvula* Fab.; fig. 3.)

The tobacco flea-beetle attacks plant beds and young plants in the field, and frequently injures tobacco until it is carried to the barn. The most serious outbreak on record occurred in the spring of 1907 in the dark-tobacco belt of Kentucky and Tennessee. Many plant beds were destroyed, and in many instances all plants upon resowed beds were destroyed.

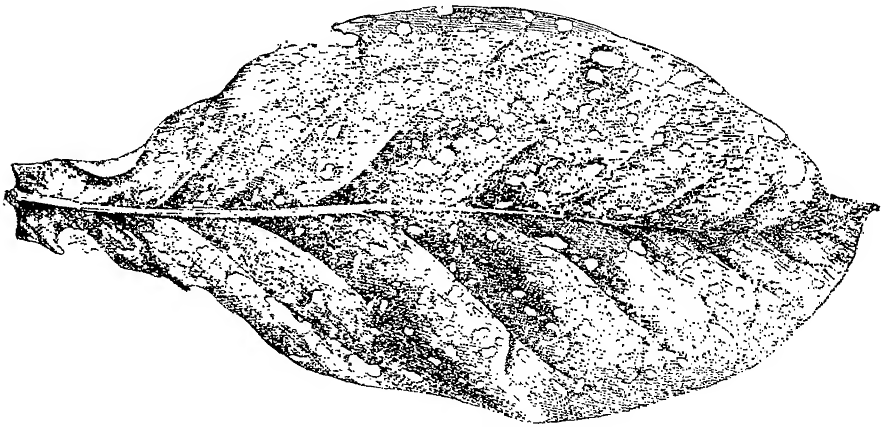

FIG. 4.—A leaf of a young tobacco plant, showing work of the tobacco flea-beetle. (Author's illustration.)

Frequently the flea-beetle seriously injures young tobacco in the field. The writer has observed fields where a large percentage of the plants was killed by its attacks. The leaves were riddled with holes (see fig. 4) and new foliage was devoured as fast as it appeared.

PREVENTIVE.—Use only whole strong canvas in canvasing seed beds, with straight boards or logs for the sides; bank up the earth three or four inches against the sides, so that no holes are left beneath, and fasten the canvas closely and securely to the sides. Beds canvased in this way escaped injury in 1907.

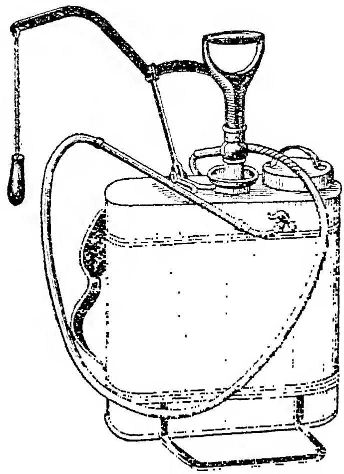

FIG. 5.—A knapsack spray pump.

REMEDIES.—Spray infested beds with arsenate of lead at the rate of 1 pound of arsenate of lead, paste form (one-half this amount of the powder), to from 12 to 16 gallons of water. Mix thoroughly and apply to the bed until every leaf is thoroughly dampened. Arsenate of lead adheres well to the foliage, and unless a very heavy rain falls the application need not be repeated until the plants have grown considerably. At setting time dip the *tops* of the plants in arsenate of lead made according to the above formula, and if flea-beetles continue to be injurious in the field spray the plants with the above insecticide, using a knapsack spray pump (fig. 5). With this pump one man can spray 5 to 6 acres of young tobacco in a day.

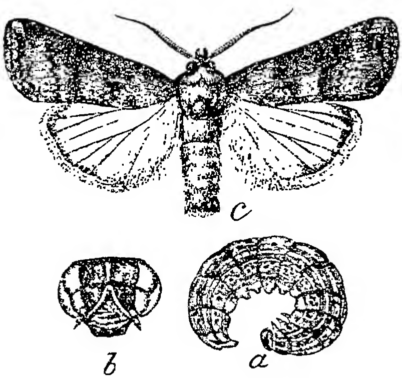

FIG. 6.—*Agrotis ypsilon*, one of the tobacco cutworms: *a*, Larva; *b*, head of same; *c*, adult. Natural size. (From Howard.)

CUTWORMS.

(Figs. 6 and 7.)

Cutworms as a class are very injurious to tobacco. Their injury consists in cutting off the top of the young plant at or near the surface of the ground. The most injurious species at Clarksville, Tenn., is *Feltia jaculifera* Guen., although *Peridroma margaritosa* Haw., *Agrotis ypsilon* Rott., and *Mamestra meditata* Grote have been collected in tobacco fields, and may become injurious under favorable conditions.

Dr. S. A. Forbes[1] has reported *Paragrotis messoria* Harr. and *P. tessalata* Harr. from tobacco in Illinois; Prof. H. Garman[2] records two species, *Feltia ducens* Walk., and *F. annexa* Treitschke, from

[1] Bul. 95, Ill. State Agr. Exp. Sta., 1904. [2] Bul. 58, Ky. Agr. Exp. Sta., 1895.

Kentucky, which may injure tobacco; and Dr. L. O. Howard[1] has observed *Mamestra legitima* Grote as common in tobacco fields in Virginia.

Peridroma incivis Guen., *Noctua c-nigrum* L., *Mamestra renigera* Steph., and *Rhynchagrotis brunneicollis* Grote have been taken in advanced stages of development from fields at Clarksville just before setting tobacco.

REMEDIES.—If possible, plow sod land in the fall, keep it free of vegetation for some weeks before tobacco is set, and thus starve the cutworms. If the field is infested with cutworms at setting time, use one of the following trap baits: Spray green clover with Paris green and drop handfuls of it about the field at intervals of a few

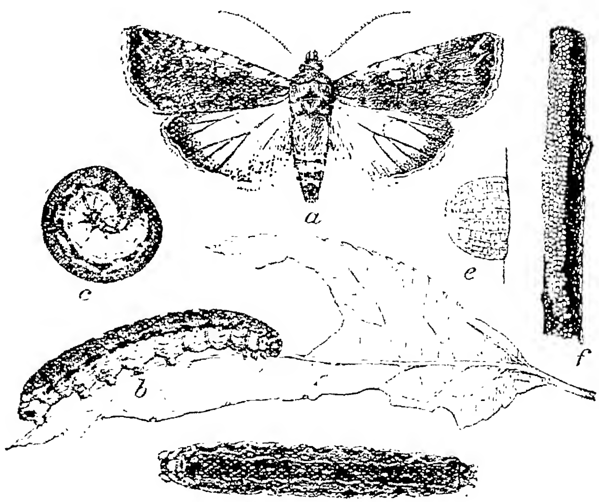

FIG. 7.—A tobacco cutworm (*Peridroma margaritosa*): *a*, Moth; *b*, normal form of larva, side view; *c*, same, in curved position; *d*, dark form of larva, from above; *e*, egg, from side; *f*, egg-mass on twig. All natural size except *e*, which is greatly enlarged. (From Howard.)

feet; or, make a poisoned bran mash by mixing 1 pound of Paris green with 50 to 60 pounds of bran, sweeten with molasses, and drop about the field four or five days before setting time. If plants have been set, drop two or three small handfuls about each hill.

THE TOBACCO HORNWORMS.

(*Phlegethontius sexta* Joh. and *P. quinquemaculata* Haw.)

The tobacco hornworms are the most serious pests of tobacco in the United States. They are found in all tobacco fields. *Phlegethontius quinquemaculata* is called the northern tobacco worm and is the

[1] Yearbook U. S. Dept. Agr., 1898.

most numerous species north of Washington, D. C.: *P. sexta* (fig. 8), the southern tobacco worm, is by far the most numerous in Tennessee and Kentucky and in tobacco districts to the south. The observations recorded here were made upon the southern species, but since the life histories and seasonal histories of the two species are so nearly alike, remedies that are recommended for the southern species will apply equally well to the northern.

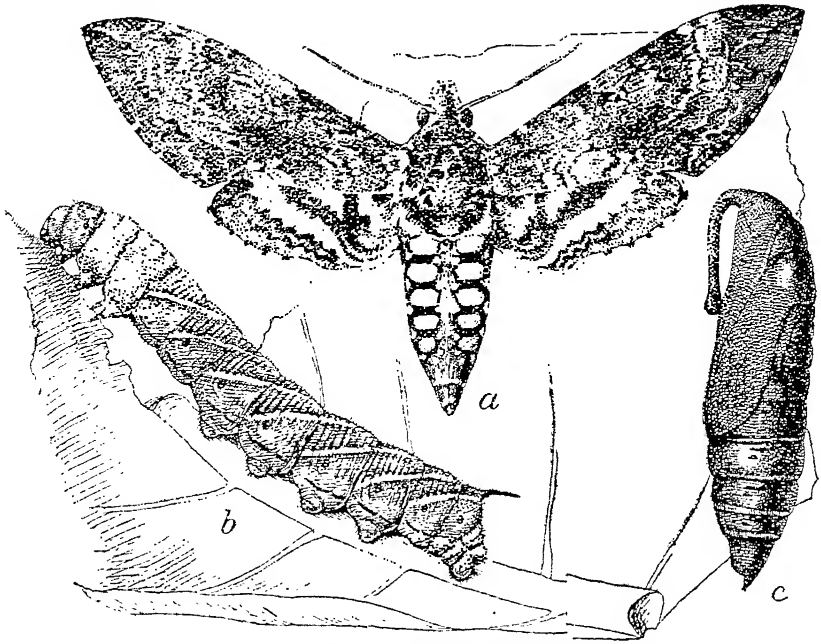

FIG. 8.—The southern tobacco hornworm (*Phlegethontius sexta*): *a*, Adult; *b*, larva; *c*, pupa. (From Howard.)

LIFE HISTORY AND SEASONAL HISTORY.—It requires forty-five to forty-eight days for the complete life cycle of the southern tobacco worm, as shown in the following table:

Average length of different stages in life history of the southern tobacco hornworm (Phlegethontius sexta).

Emergence of moth to oviposition.	Incubation period.	Instars, or stages, in growth of larva.					Total larval period.	Pupal period.	Total life cycle.
		First.	Second.	Third.	Fourth.	Fifth.			
Days. 4	*Days.* 4	*Days.* 3	*Days.* 3	*Days.* 3	*Days.* 4—	*Days.* 6.5	*Days.* 19.5	*Days.* 21	*Days.* 48

Eggs deposited June 1, June 15, July 1, or July 15 will hatch, the larvæ or worms will mature upon tobacco, will enter the ground, where they remain about three weeks in the pupal stage, and will emerge as moths of the second generation about July 15, August 1, August 15, and September 1, respectively. Larvæ that enter the ground after August 10 to pupate are very likely to hibernate. Therefore, only moths that are abroad before July 15 will produce a second generation. The annexed table gives the record of emergence during 1908 and 1909.

Record of emergence of tobacco moths from hibernation.

Period of emergence.	Emergence during period.	Period of emergence.	Emergence during period.
1908. [a]	*Per cent.*	1909. [b]	*Per cent.*
June 1 to July 15	34.5	June 1 to July 15	17.5
July 16 to August 13	65.5	July 16 to August 22	83.5
July 21 to July 31	52	July 29 to August 9	50
July 21 to August 13	63.8	July 29 to August 22	59

[a] Emergence began about June 1. [b] Emergence began June 1.

Note in the second line of the table the large percentage of moths that emerge after midsummer. Practically none of these moths will produce a second generation, and many of the moths that emerge just prior to July 15 will not produce a second generation in time to injure early tobacco.

Hibernation.—The tobacco moth hibernates as a pupa (see fig. 9, *c*) in an oval cell, at an average depth of about 4 inches for second bottom soils of the Cumberland River. Numerous experiments at Clarksville, Tenn., 1907 to 1910, demonstrate that usually not more than 25 per cent of the hibernating stage pass the winter successfully. This stage is, therefore, a critical period in the seasonal history of the insect. Hence any artificial disturbance of natural conditions should produce an increased mortality. The most simple means of disturbance is by disking or plowing. Disking reaches only a small percentage of the cells and increases the mortality to a very slight extent, but plowing increases the mortality greatly. Of the pupæ used in the plowing experiment in the fall of 1908 only 15 per cent as many emerged in 1909 as from the unplowed check. The experiment was repeated in the fall of 1909, and in 1910 no moths emerged from that experiment, although approximately the normal emergence occurred in the unplowed check. The large mortality in the latter experiment is thought to be due to the hard winter of 1909–10. In plowing land it is necessary to plow only to the usual depth, for very few larvæ will enter the harder ground below to pupate.

Remedy for hornworms in the field.—Paris green, dusted on tobacco by means of a dust gun (fig. 10), is in common use in Ken-

tucky and Tennessee with very good results. Burning of the plant often occurs from the use of Paris green. This is usually, though not always, due to a failure to make an even application. From 1 to 2 pounds per acre are applied, without a diluent or carrier. The

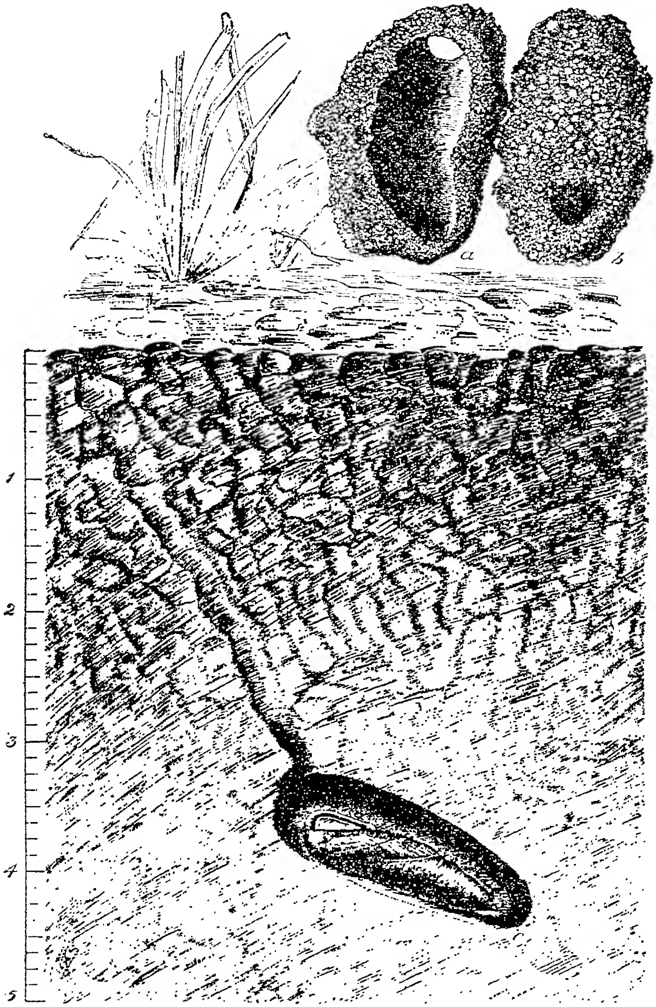

FIG. 9.—Hibernation of the southern tobacco hornworm: *c*, Pupa in hibernating cell in soil, at the depth at which pupation usually takes place in the stiffer soils; *a*, cross section of pupal cell viewed from below; *b*, pupal cell showing entrance hole of larva or "worm." Two-thirds natural size. (Author's illustration.)

writer has found that 1½ pounds per acre, if carefully applied when there is very little or no breeze, is an effective remedy against all except the largest worms. The nearly full-grown worms (fig. 8, *b*) should be hand-picked or they will do considerable injury before they succumb to the poison, if, indeed, they do succumb.

Since engaging in the investigation of tobacco insects the writer has endeavored to find a poison that could be used successfully against the hornworms, and one that would not burn tobacco. It is a pleasure to report that such an insecticide has been found in powdered arsenate of lead. This poison is, however, more costly than Paris green, for from 4 to 5 pounds should be applied per acre, at a cost of 80 cents to $1. Arsenate of lead must be mixed with a carrier. The writer finds that sifted ashes is the most satisfactory. Finely sifted air-slaked lime was tried, but did not dust evenly.

FIG. 10.—Applying poison to tobacco with a dust gun. (Author's illustration.)

An even, thorough application is absolutely necessary for good results. Only the *arsenates of lead* that are *especially prepared for use upon tobacco* should be used, for brands not thus prepared have been found to be too slow in their insecticidal action.

THE BUDWORMS.

(*Chloridea virescens* Fab. and *Heliothis obsoleta* Fab.; figs. 11 and 12.)

The first of these species is called the true budworm, the second the false budworm. The latter species is cosmopolitan, and is the most injurious.

According to Prof. A. L. Quaintance,[1] it is the most abundant in Florida. In the shade-tobacco districts of Georgia and Florida the budworms are more injurious than the hornworms and are more costly to combat. The eggs are deposited in the tips or buds of the plant, and a single larva may eat through several leaves, rendering them unfit for wrappers and thereby greatly reducing their value.

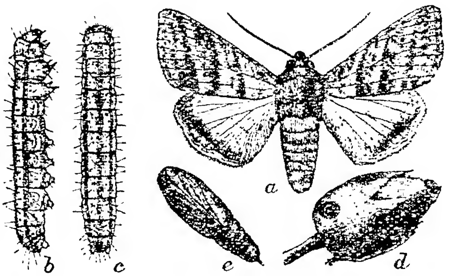

FIG. 11.—The true budworm (*Chloridea virescens*): *a*, Adult moth; *b*, full-grown larva, from side; *c*, same, from above; *d*, seed pod bored into by larva; *e*, pupa. Natural size. (From Howard.)

Shade-tobacco growers in Georgia and Florida have to poison twice a week for the budworms during the growing season. The usual insecticide is Paris green at the rate of 1 tablespoonful to a peck of sifted corn meal. This mixture is sifted into the bud. According to Mr. W. A. Hooker,[2] the annual cost of treating the budworms for labor and supplies averages from $12 to $15 per acre.

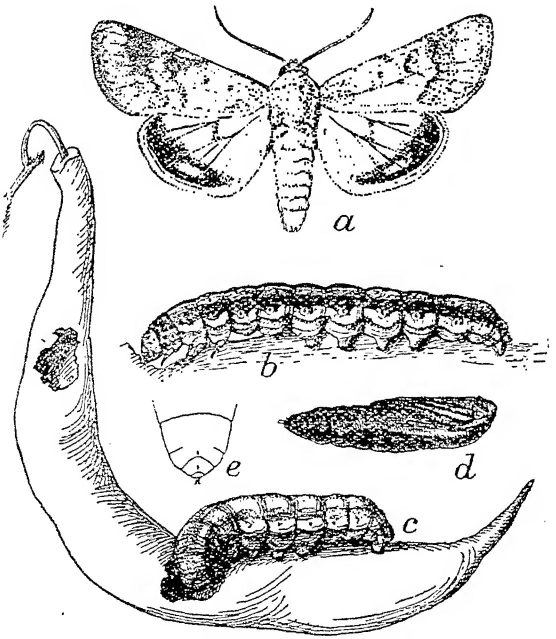

FIG. 12.—The false budworm or cotton bollworm (*Heliothis obsoleta*): *a*, Adult moth; *b*, dark full-grown larva; *c*, light-colored full-grown larva; *d*, pupa. Natural size. (From Howard.)

THE TOBACCO SPLITWORM.

(*Phthorimæa operculella* Zeller; fig. 13.)

The cosmopolitan tobacco splitworm was first reported from tobacco in this country by Prof. Gerald McCarthy, in 1897, in Bulletin 141 of the North Carolina Agricultural Experiment Station, under the name of *Gelechia picipelis* Zett.

In 1898 Prof. A. L. Quaintance, in Bulletin 48 of the Florida Agricultural Experiment Station, stated that the larvæ usually made

[1] Bul. 48, Fla. Agr. Exp. Sta., 1898.

[2] Bul. 67, Bur. Ent., U. S. Dept. Agr., 1907.

their appearance about the last of May at Lake City; that the life cycle was found to be not more than twenty days; that the larvæ are miners, living between the upper and lower epidermis of the leaves, and that by their work they render the leaves worthless for wrappers (Pl. XX, fig. 1). They have the habit of leaving their mines and crawling over the surface of the leaf to mine in another place. This habit led Professor Quaintance to suggest an arsenical spray. According to him, the winter may be passed either as larvæ or pupæ in rubbish upon the surface of the ground. It therefore becomes advisable to destroy all trash in and around tobacco fields and tobacco barns.

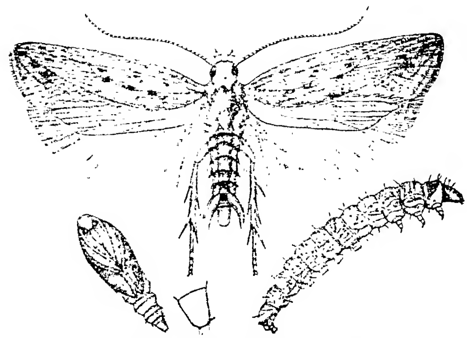

FIG 13.—The tobacco splitworm (*Phthorimæa operculella*): Adult moth above; larva below at right; pupa below at left, with side view of enlarged anal segment. All enlarged. (From Howard.)

The writer found that this insect injured tobacco at Dade City, Fla., in 1908, to the extent of $150 per acre. In 1909 and 1910 laborers went through the fields every three or four days and picked and destroyed all infested leaves. Loss in 1909 was light, and in 1910 very light.

THE TOBACCO THRIPS.

(*Euthrips fuscus* Hinds; fig. 14.)

Specimens of the tobacco thrips from Florida were described as *Euthrips nicotianæ*, new species, by Dr. W. E. Hinds, who later identified it with *E. fuscus* Hinds, described from Massachusetts. It was first reported injurious to tobacco in Florida in 1902. It sucks the leaves along the veins, producing a whitened inelastic vein which breaks too easily for use as a wrapper. In 1905 Mr. W. A. Hooker

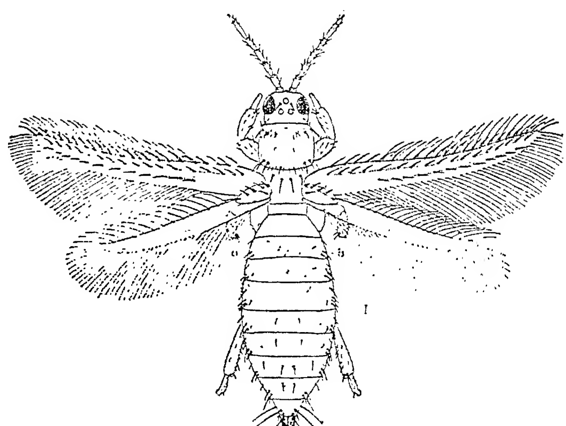

FIG. 14.—The tobacco thrips (*Euthrips fuscus*). Greatly enlarged. (After Hooker.)

made a careful study of this insect and published his results as Bulletin 65 of the Bureau of Entomology.

Mr. Hooker states that the life cycle requires only twelve to thirteen days in May and June and that the insect probably hibernates as an adult. Preliminary experiments have led the writer to suspect that the adult has a subterranean habit of hibernation. It feeds upon many species of plants.

Mr. Hooker found that kerosene emulsion was the cheapest and most efficient remedy. He recommends the following stock solution: Kerosene, 2 gallons; hard soap, ½ pound; water, 1 gallon. A strength of 1 part stock solution to 10 parts of water proved to be effective in killing the thrips, but it was found to injure tobacco seriously if applied in strong sunlight. Spraying is done, therefore, late in the afternoon and at night, beginning not earlier than 5 o'clock on bright days.

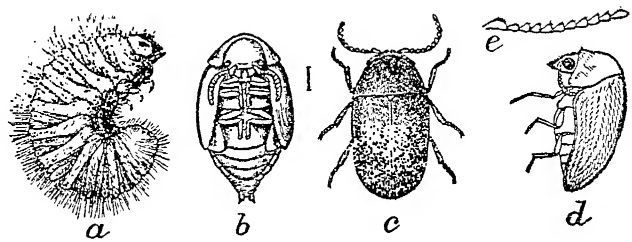

FIG. 15.—The cigarette beetle (*Lasioderma serricorne*): *a*, Larva; *b*, pupa; *c*, adult; *d*, side view of adult; *e*, antenna. *a–d*, Greatly enlarged; *e*, still more enlarged. (Reengraved from Chittenden's illustration.)

THE TOBACCO CRAMBUS.

(*Crambus caliginosellus* (?) Clemens.)

The tobacco crambus was recorded from tobacco by the late Prof. W. G. Johnson in 1899.[1] Johnson stated that it was very injurious in Maryland, boring into and feeding upon the stems of the newly set plants. This insect has been so destructive to tobacco in Virginia that it has been made the subject of a special investigation by the Bureau of Entomology. Mr. G. A. Runner, to whom the investigation has been assigned, will in the near future issue a special bulletin giving the results of his investigations.

THE CIGARETTE BEETLE.

(*Lasioderma serricorne* Fab.; fig. 15.)

Severe loss to the tobacco trade is caused every year by the cigarette beetle. (See Pl. XX, fig. 2.) It breeds in practically all cured tobaccos, except those richest in nicotine.

REMEDIES.—Small lots of infested tobacco, like cigars, cigarettes, and boxes of pipe tobacco, may be successfully treated by opening

[1] See Bul. 20, n. s., Div. Ent., U. S. Dept. Agr., p. 99.

the boxes so that the gas will enter, placing them in an air-tight box, and fumigating with carbon bisulphid, using 1 ounce of the liquid to every 50 or 60 cubic feet of space. The liquid should be placed in a shallow receptacle above the tobacco, for the gas is heavier than air. Large buildings or rooms may be fumigated with this gas. In these cases securely chink all cracks, place the liquid in pans near the ceiling, and fumigate for from 12 to 24 hours, using 1 pound of carbon bisulphid to 600 or 800 cubic feet.

CAUTION.—Do not bring fire into the room while the liquid is evaporating, for the gas is very inflammable. Air the room before entering. A small amount of the gas may be inhaled without ill effects, but a slight dizziness or nausea is the signal for retreat.

Hydrocyanic-acid gas has been used to fumigate factories with good results. Great caution should be exercised in using it, as it is highly poisonous. For directions for using this gas obtain Circular No. 46 of the Bureau of Entomology.

No satisfactory method of treatment has been found for this beetle in baled tobaccos. This question is a serious one with cigar manufacturers and demands investigation.

INSECTS OF SECONDARY IMPORTANCE.

For convenience of treatment, the large number of insects falling into this category may be divided as follows: (1) Insects attacking the seed bed; (2) insects attacking young transplanted plants; (3) insects injuring the foliage; (4) insects injuring the stem; (5) insects injuring the root and stem; (6) insects attacking cured and manufactured tobaccos; (7) insects attacking tobacco seed.

INSECTS ATTACKING THE SEED BED.

The most serious insect of secondary importance that attacks the seed bed has been recorded by Mr. Z. P. Metcalf.[1] It is the grouse locust (*Tettigidea lateralis* Say), which he found seriously injuring plant beds at Stem, N. C. This species has also been found rather common upon seed beds at Clarksville, Tenn. Mr. Metcalf advises that plant beds should not be placed near low, marshy ground. As a remedy he advises the spraying of a strip 3 feet wide around the plant bed with kerosene emulsion.

Mr. S. E. Crumb and the writer have found several species of Orthoptera (*Tettix arenosus* Burm., *Paratettix cucullatus* Burm., *Nomotettix compressus* Morse, and *Chortophaga virdifasciata* DeG.) injuring tobacco in seed beds at Clarksville, Tenn., and *Ellipes minutus* Scudd. has been taken with them, although it was not observed feeding upon tobacco.

[1] Insect enemies of tobacco. Supplement to Oct. Bul., 1909, N. C. Dept. Agr.

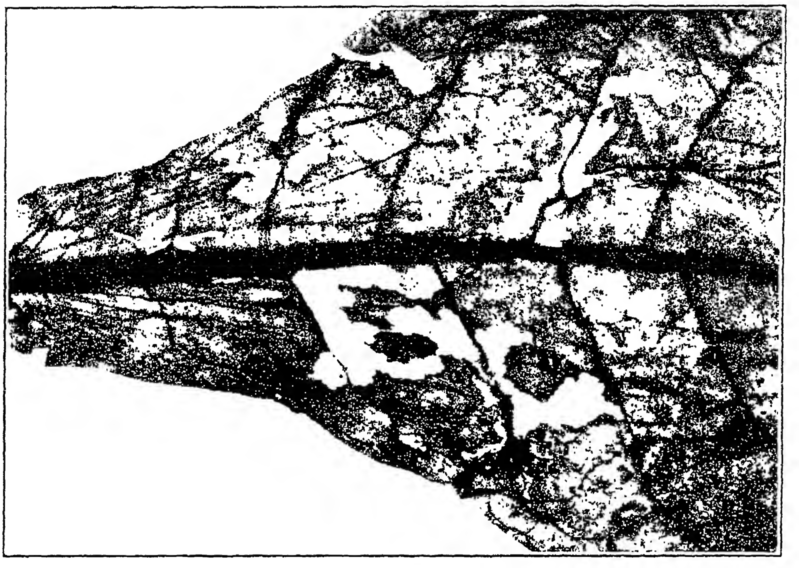

FIG. 1.—MINES OF TOBACCO SPLITWORM IN WRAPPER TOBACCO. (ORIGINAL.)

FIG. 2.—WORK OF LARVÆ OF CIGARETTE BEETLE IN CUT PLUG SMOKING TOBACCO. (ORIGINAL.)

REMEDIES.—The kerosene-emulsion repellent and the arsenate of lead spray will be found efficient remedies for insects attacking the plant bed.

INSECTS ATTACKING YOUNG TRANSPLANTED PLANTS.

The most serious injury to transplanted tobacco, besides that by the insects of primary importance, is perhaps by wireworms. Of these the most serious is *Horistonotus curiatus* Say, which was reported by Mr. S. A. Thomas, of Clemson College, S. C., as severely injuring tobacco in two localities in that State in 1910, by boring into the stem. In June, 1909, the writer found larvæ of the tomato stalk borer (*Papaipema nitela* Guen.) boring in the stem and midribs of young tobacco at Clarksville, Tenn. Mr. Z. P. Metcalf[1] records that the mole cricket *Anurogryllus muticus* De Geer was injurious locally in North Carolina by cutting off the young plants. Mr. W. A. Hooker records two tenebrionid beetles (*Blapstinus metallicus* Fab. and *Opatrinus notus* Say) and the snout-beetle *Epicærus formidolosus* Boh. as hiding beneath and eating the wilted leaves of newly set tobacco plants in a field at Quincy, Fla.

INSECTS INJURING THE FOLIAGE.

Into this class fall by far the greater number of the secondary pests of tobacco. The worst depredators of this class belong to the Orthoptera and to the Hemiptera.

Of the Orthoptera the most injurious species is perhaps *Melanoplus atlanis* Riley, which occasioned serious injury to tobacco fields in the vicinity of Clarksville, Tenn., during 1910. This pest injures tobacco by eating holes in the leaves and by ragging the edges. The writer found that poisoning tobacco for the hornworms was an efficient remedy against this insect. Other species taken on tobacco at Clarksville are the grasshoppers *Melanoplus scudderi* Uhl. and *M. differentialis* Thom., the tree-crickets *Œcanthus nigricornis* Walk. and *Œ. latipennis* Riley, and the long-horned grasshoppers *Scudderia furcifera* Scudd. and *Xiphidion strictum* Scudd. Dr. W. E. Britton[2] records the grasshopper *Dissosteira carolina* L. as quite a severe depredator of tobacco in Connecticut, and further states that *Melanoplus femur-rubrum* DeG., *Scudderia texensis* Sauss-Pictet, *S. Septentrionalis* Serv., *Xiphidion brevipenne* Scudd., *X. fasciatum* DeG., *Œcanthus nigricornis* Walk. (var. *quadripunctatus* Beut.), and *Œ. fasciatus* Fitch are occasionally injurious in Connecticut.

Prof. A. L. Quaintance,[3] in addition to *Melanoplus femur-rubrum*, has recorded *M. bivitattus* Say as injuring tobacco in Florida. Mr. Z. P. Metcalf reports the grasshopper *Trimerotropis citrina* Scudd.

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[1] Insect enemies of tobacco. Supplement to Oct. Bul., 1909, N. C. Dept. Agr.

[2] Sixth Rept. Conn. State Ent. f. 1906 (1907).

[3] Bul. 48, Fla. Agr. Exp. Sta., 1898.

Dr. C. V. Riley[1] recorded a species of Gryllus from Louisiana, and Prof. Gerald McCarthy has recorded the snowy tree-cricket (*Œcanthus niveus* DeG.) from North Carolina.

Hemiptera injure tobacco by sucking the stems and midribs, thereby causing "wilt," and by sucking the leaves, in which case discolored and deadened areas result. Probably the most injurious species is the tobacco suckfly (*Dicyphus minimus* Uhl.). Professor Quaintance[2] states that this insect is very widely distributed in Florida, and it has been recorded from Louisiana, Texas, Mississippi, and Alabama. It causes wilt of tobacco, and plants severely attacked are believed never to recover. According to Professor Quaintance[3] it is injurious only upon late tobacco. He found that a tobacco decoction made by boiling 1 pound of refuse tobacco leaves for one hour in water, diluted in 1 gallon of water and sprayed upon the plants, was an effective remedy. A 10 per cent strength of kerosene emulsion was also found effective but very injurious to foliage.

Prof. H. Garman[4] reported the plant-bug *Euschistus variolarius* Pal. Beauv. as wilting tobacco at Lexington, Ky., in 1896; Dr. W. E. Britton recorded it in Connecticut in 1905. Mr. Z. P. Metcalf[5] has reported *Euschistus servus* Say wilting tobacco in North Carolina. *E. tristigmus* Say and *E. fissilis* Uhl. have been found to be rather common upon tobacco at Clarksville, Tenn. Dr. L. O. Howard[6] records the leaf-bug *Pœciloscytus diffusus* Uhl. as very common in tobacco fields in Virginia, and that *Thyreocoris* (*Corimelæna*) *extensa* Uhl. has been found damaging native tobacco in Arizona. Dr. W. E. Britton[7] states that the tarnished plant-bug (*Lygus pratensis* L.) is common in tobacco fields in Connecticut and that it probably injures tobacco. Mr. S. E. Crumb, of the Bureau of Entomology, has observed the stilt-bug *Jalysus spinosus* Say sucking tobacco at Clarksville, Tenn. The plant-bugs *Thyanta custator* Fab. and *Corizus lateralis* Say have also been collected by him from tobacco. Mr. W. A. Hooker reports that the two leafhoppers or sharpshooters *Aulacizes irrorata* Fab. and *Oncometopia lateralis* Fab. are rather common in tobacco fields in Florida, and that the latter is supposed to injure the bud.

Doctor Howard[6] found that the mealy bug *Pseudococcus citri* Risso lived and multiplied alarmingly upon tobacco in a greenhouse in Washington, D. C.

In 1898 Mr. Theo. Pergande, of the Bureau of Entomology, described an aphis, *Nectarophora tabaci*, from tobacco in the District of Columbia and Maryland.

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[1] Insect Life, Vol. I, pp. 87–88, 1888.
[2] Bul. 48, Fla. Agr. Exp. Sta., 1898.
[3] Loc. cit.
[4] Bul. 66, Ky. Agr. Exp. Sta., 1897.
[5] Insect enemies of tobacco. Supplement to Oct. Bul., 1909, N. C. Dept. Agr.
[6] Yearbook U. S. Dept. Agr., 1898.
[7] Sixth Rept. Conn. State Ent. f. 1906 (1907).

Dr. Britton[1] has recorded the greenhouse white-fly (*Aleyrodes vaporariorum* Westw.) as injuring tobacco in greenhouses in Connecticut, and the writer has found eggs and adults of *Aleyrodes abutilonea* Hald. upon tobacco at Clarksville, Tenn.

In the present article only seven species of Lepidoptera are treated as secondary pests of tobacco. The most common of these at Clarksville, Tenn.—though found very rarely—are the climbing cotton cutworm (*Prodenia ornithigalli* Guen.) and *Autographa brassicæ* Riley. In September, 1909, the writer found larvæ of *Autographa verruca* Fab. upon tobacco suckers at Quincy, Fla. During 1910 Mr. S. E. Crumb and the writer have taken larvæ of *Loxostege mancalis* Led., *Diacrisia virginica* Fab., and *Estigmene acræa* Drury feeding upon tobacco at Clarksville. Mr. W. A. Hooker[2] has also recorded the last species from Florida. *Hyphantria textor* Harr. was taken at Clarksville ovipositing upon tobacco, although it is very unlikely that the larvæ feed thereon.

Besides the flea-beetles, which attack tobacco in the field as well as in the plant bed, the gray blister beetle (*Epicauta cinerea* Forst.) is perhaps the worst pest among the beetles. Mr. Z. P. Metcalf[3] states that it severely ragged tobacco in some fields in North Carolina in 1909. The twelve-spotted cucumber beetle (*Diabrotica duodecimpunctata* Oliv.) has been observed feeding upon tobacco at Clarksville, Tenn., and the Colorado potato beetle (*Leptinotarsa decemlineata* Say) has been reported from tobacco. Future observations will undoubtedly disclose that many other beetles also feed to some extent upon tobacco.

INSECTS INJURING THE STEM.

The two snout-beetles *Trichobaris insolita* Casey and *T. mucorea* Lec. have been recorded by Dr. F. H. Chittenden[4] as breeding in tobacco stems. The former has been reported from Texas and Florida, while the latter has been reported only from Florida. Injury has rarely been severe. Doctor Chittenden recommends clearing the tobacco fields of all stalks and of all rubbish in which the beetles could find shelter, dipping young plants in arsenate of lead at setting time, and later spraying with the same insecticide to kill the beetles while they are feeding.

INSECTS INJURING THE ROOT AND STEM.

Wireworms are the principal insects of secondary importance that injure the root and stems of tobacco. Dr. W. E. Britton[1] reports

[1] Sixth Rept. Conn. State Ent. f. 1906 (1907).
[2] Bul. 67, Bur. Ent., U. S. Dept. Agr., p. 109, 1907.
[3] Insect enemies of tobacco Supplement to Oct. Bul., 1909, N. C. Dept. Agr.
[4] Bul. 38, n. s., Bur. Ent., U. S. Dept. Agr., p. 68, 1902.

larvæ of *Melanotus cribulosus* Lec. and of the genus Asaphes as injuring tobacco in Connecticut, and that adults of *Limonius griseus* Beauv. were quite common in tobacco fields. Adults of *Monocrepidius bellus* Say are quite common in tobacco fields at Clarksville, Tenn., although very little injury is occasioned by wireworms. Mr. W. A. Hooker[1] reports larvæ of *Drasterius* sp. as injurious in 1905 in one field at Quincy, Fla.

INSECTS ATTACKING CURED AND MANUFACTURED TOBACCOS.

Besides the cigarette beetle, only three species are recorded as injuring cured and manufactured tobaccos. These are the rice weevil (*Calandra oryza* L.), the drug-store beetle (*Sitodrepa panicea* L.), and *Dermestes vulpinus* Fab. The remedies are the same as for the cigarette beetle.

INSECTS ATTACKING TOBACCO SEED.

In the 1905 Yearbook of the United States Department of Agriculture Dr. F. H. Chittenden states that the tobacco-seed beetle (*Catorama impressifrons* Fall) was identified as the beetle concerned in the injury to tobacco seed in Cuba and Texas in earlier years. The writer, in January, 1909, found larvæ and adults of the black carpet beetle (*Attagenus piceus* Oliv.) in a bottle of imported Cuban seed. The bottle has been upon his desk for nearly two years, and live larvæ are still to be found in it. In the same bottle the book louse (*Troctes divinatorious* Müll.) was found in large numbers. In 1910 the writer found the latter insect infesting tobacco seed at Quincy, Fla. A cecidomyiid was also taken from the above-mentioned bottle of seed in September, 1910.

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[1] Bul. 67, Bur. Ent., U. S. Dept. Agr., 1907.

BITUMINOUS DUST PREVENTIVES AND ROAD BINDERS.

By Prévost Hubbard,

Chemist, Office of Public Roads.

USE OF BITUMENS ON ROADS.

At the present time bitumens undoubtedly constitute the most important class of materials employed as dust preventives and road binders. In one form or another they are extensively used for this purpose by all civilized countries where the preservation of roads has become a serious problem because of the destructive action of automobile traffic.

In the broadest sense bitumens may be defined as mixtures of native or pyrogenetic hydrocarbons and their derivatives, which may be gases, liquids, viscous liquids, or solids. If solids, they melt more or less readily upon the application of heat and are soluble in carbon bisulphid, chloroform, and similar solvents. They may be conveniently divided into two main classes: (1) native bitumens and (2) artificial bitumens. Native bitumens, as their name implies, occur in nature, and often contain impurities such as water, clay, silt, sand, and extraneous organic or vegetable matter. Those of interest as road materials are petroleums, malthas, asphalts, and other solid products of an asphaltic nature, such as gilsonite and grahamite. Artificial bitumens are distillates and residues produced by the partial or fractional distillation of bitumens, and hydrocarbon distillates produced by the destructive distillation of bitumens, pyrobitumens, and other organic materials, such as wood or bone. Manufactured petroleum residuums, oil asphalts, asphaltic cements, coal tars, and water-gas tars are the most important members of this class from the standpoint of road treatment and construction.

TREATMENT OF NATIVE BITUMENS.

Comparatively few native bitumens are, in their original condition, suitable for use on roads, but many of them can be made so by proper treatment or modification. Thus a hard, native asphalt may have to be fluxed to suitable consistency with a petroleum residuum, or a fluid asphaltic petroleum may have to be brought to proper

consistency by distilling off a certain percentage of its lighter and more volatile constituents. After undergoing such treatment, these materials are, properly speaking, artificial or manufactured products.

Fluxing and distilling are the two principal processes involved in the preparation of bituminous dust preventives and road binders. The fluxing process consists in mixing or combining a hard or solid bitumen with one that is more or less fluid, called the flux. This combination is usually facilitated by the application of heat and mechanical agitation. Fluxing may serve one of two purposes: A hard bitumen may be softened to the desired consistency by the addition of a relatively small amount of a fluid bitumen, or a heavy viscous oil may be reinforced or hardened by the addition of a relatively small amount of some solid bitumen. In rare instances the proportion of flux to the material fluxed may be equal. In the preparation of fluxed road binders it is not essential that the flux show any binding value unless it constitutes the greater part of the finished product. The material fluxed should, however, invariably possess high binding value or should impart binding value to the finished product. Solid bitumens of asphaltic character possess this property, while those of a paraffin nature do not. The former are, therefore, of value as road materials, while the latter are valueless in this connection. On the other hand, fluxes composed largely of paraffin hydrocarbons may prove very satisfactory, providing they do not constitute the greater part of the finished product.

There are two general methods of distillation in use in the manufacture of bituminous dust preventives and road binders—fractional distillation and destructive distillation. In each, two classes of products are formed—distillates and residues. Fractional distillations cause a mechanical separation of the more volatile from the less volatile constituents of the material distilled, while destructive distillation causes a complete chemical change in which the identity of the material is destroyed.

BITUMINOUS DISTILLATES AND RESIDUES.

Distillates obtained from the fractional distillation of bitumens show no binding value and are unsuitable for use as road materials, except occasionally in the capacity of fluxes. The residues from fractional distillation may or may not possess binding value, according to the character of the material distilled and the extent to which distillation has been carried. If they possess binding value and are of suitable consistency, they may prove satisfactory for the treatment or construction of roads. Residual tars and residual asphaltic petroleums are examples of this type of road material. When distillation is carried so far that the residues are hard and more or less brittle when cold, these residues are called pitches. This term is then pre-

fixed with the name of the material distilled, such as coal-tar pitch or oil pitch. Hard, brittle pitches are unsuitable for road construction, but many of them can be made suitable by fluxing them to the desired consistency with a fluid bitumen. If a distillate is used for fluxing, the resulting product is said to be cut back. Sometimes volatile distillates are used for the purpose of cutting back. When this is done, the material which is cut back usually has the consistency which it is desired will be maintained in the road, and the volatile distillate is employed merely for the purpose of facilitating application by making the material more fluid. After the product has been applied this distillate volatilizes and leaves the original material in place to serve as a binder.

Unlike fractional distillation, destructive distillation often produces distillates having excellent binding value. When these distillates are composed of hydrocarbons and their derivatives, they are known as tars. The residue from destructive distillation is merely coke or carbon and is of no interest as a road material. Hydrocarbon distillates obtained from the destructive distillation of coal and oil are, however, of considerable interest. They are known as coal tars and oil tars. Tars are for the most part by-products of industrial processes and are commonly known by the name of the plant or process in which they are formed; for example, gas-house coal tar, coke-oven tar, oil-gas tar, water-gas tar. Water-gas tar, so called because it is formed in the manufacture of carbureted water gas, is in reality an oil tar. It is produced by a peculiar method of destructively distilling oil for the purpose of enriching water gas. Crude tars, as obtained from the industrial processes above mentioned, are of little value as road materials unless subjected to fractional distillation. If thus treated, only the residues possess binding value as described in the preceding paragraph, while the distillates are of a greasy nature.

CLASSIFICATION OF BITUMINOUS ROAD MATERIALS.

Now that some idea of the types of bitumen in use as road materials has been obtained, it may be well to take up their further classification under the headings "Dust preventives" and "Road binders." No very definite distinction can be made between the two classes, for the function of both is in reality the same. There are certain differences, however, which may be shown by the following definitions. Dust preventives are materials applied to the surface of finished roads for the purpose of laying the dust already present and of retaining dust which may be brought upon the road from outside sources. In bituminous dust preventives it is highly desirable, if not absolutely essential, that the material act as a binder for the loose mineral particles upon the road surface before treatment, and also for any sand, gravel, or stone chips which may afterwards be applied.

Bituminous dust preventives which do not bind are apt to destroy the already existing bond of the road surface and to hasten the ultimate disintegration of the road. Road binders are materials employed in the construction or reconstruction of roads for the purpose of holding together and in place the individual particles of which the road is composed. By so doing they reduce the wear of the road under traffic, and therefore tend to prevent the formation of dust from the road material.

In most instances the same type of bitumen that will give satisfaction as a dust preventive will also give satisfaction as a road binder. The principal difference between the two is only a matter of consistency. This is true in so far as type is concerned. There are, however, various physical and chemical differences to be found among members of a given type, which will, of course, have to be taken into account in connection with the purpose for which the bitumen is used.

With this understanding the more important bituminous dust preventives and road binders now in use may be classified as follows:

Bituminous dust preventives:
- Crude asphaltic petroleums.
- Fluid malthas.
- Fluid semiasphaltic and asphaltic petroleum residuums.
- Emulsions of very viscous semiasphaltic and asphaltic petroleum residuums.
- Dehydrated coal tars.
- Fluid coal tar and water-gas tar residuums.

Bituminous road binders:
- Very viscous malthas.
- Rock asphalts.
- Fluxed native asphalts, gilsonites, and grahamites, known as asphaltic cements.
- Semisolid, semiasphaltic, and asphaltic petroleum residuums or oil asphalts.
- Very viscous cut-back asphaltic cements and oil asphalts.
- Very viscous and semisolid coal tar and water-gas tar residuums.
- Very viscous cut-back coal-tar residuums.

SELECTION OF MATERIAL.

From among such a large and varied assortment of materials it is often a difficult matter for the road engineer to select that product which will give the best results consistent with reasonable economy. The principal factors which he has to consider in making his selection are (1) the character of the road to be treated, including the type of road (earth, gravel, or broken stone) and the physical characteristics of the road material; (2) the desired method of application, i. e., whether the material is to be applied cold or hot and by means of a sprinkler, with or without pressure, by pouring from buckets, or as a prepared mixture with the road material, and in the latter

case it is also desirable to know in advance whether or not the road material itself is to be heated; (3) the quantity and character of traffic; (4) the climatic conditions; (5) the cost of bituminous material; and (6) the probable cost of application.

After a selection has been made, much depends upon applying the material properly if satisfactory results are to be obtained. In regard to the application of dust preventives, it should be said that they may be used either as temporary binders or as semipermanent binders. The temporary binders are applied to road surfaces mainly for the purpose of laying dust. In order to lay the dust brought upon the road from outside sources, they must, therefore, be applied at frequent intervals and for reasons of economy must be capable of easy application. The only economical method of applying them is by means of a sprinkling cart, and they must, therefore, be quite fluid or else capable of emulsifying with water. Their dust-laying effect is of short duration, because they soon become saturated with dust, and are thus rendered incapable of holding down fresh dust which may be formed or brought upon the road. If they possess good binding value, they concentrate upon the road surface after a number of applications and become in effect semipermanent binders. They may often be used to advantage on roads constructed with a bituminous binder. No definite rule can be laid down in regard to the frequency with which they should be applied, as this is not only dependent upon the character of each material, but also upon local conditions to which the road is subjected.

SEMIPERMANENT BINDERS.

Those bituminous dust preventives which may be classed as semipermanent binders are applied to road surfaces mainly for the purpose of preserving the road from wear, although they also serve as dust layers for some time after application. A single application of these materials should preserve the road surface from disintegration and appreciably lessen dust formation for the period of at least one year. They can not, however, be expected to keep a road dustless for this length of time where any considerable quantity of dust from outside sources is encountered.

The semipermanent bituminous binders are rather viscous liquids containing an appreciable amount of true binding base. They are applied cold or hot according to their viscosity at ordinary temperatures. Cold applications may sometimes be made by means of an ordinary sprinkling cart, but hot applications require hand labor or else especially constructed sprinkling contrivances, usually known as oil distributors. Distributors carrying spraying devices and so equipped that the material may be heated in the cart and forced

upon the road surface under pressure of air or steam are extensively employed in England and France, and such machines are gradually being adopted in this country.

The heavier dust preventives seldom prove effective for over a year. They rarely withstand satisfactorily the severities of winter weather and winter traffic, and may therefore best be applied in the early spring at the beginning of the dusty season in order that their beneficial effect may be of longest duration. It is poor policy to apply them to worn out or badly rutted road surfaces, as their function is not to make a bad road good, but to keep a good road in good condition. In most cases it is desirable and in some absolutely necessary to remove all loose dust and detritus from the road surfaces before applying them and any repairs required should of course be made before their application. These materials give best results on broken stone or gravel roads which are not subjected to exceedingly severe traffic conditions, but which require some medium to consolidate or hold down their wearing surface. They are sometimes used in the treatment of earth roads, but it is usually better practice to reconstruct such roads with the addition of a suitable binder during construction.

SURFACING FOR LIGHT TRAFFIC.

While automobile traffic undoubtedly causes more damage to the average untreated road than horse-drawn traffic, the reverse is true of roads the surface of which has been treated with a bituminous dust preventive. Surface treatment proves most satisfactory when employed under conditions similar to those encountered on park and pleasure drives. Such roads are, as a rule, subjected to automobile and light horse-drawn traffic only, and no heavily-loaded teams are allowed to use them. Under these conditions the film or mat of bituminous-bound material is not greatly damaged by iron-shod hoofs and iron-tired wheels, and what damage is done is largely repaired by the passage of rubber-tired automobile wheels which continually iron out the marks made by the other class of traffic. Automobiles themselves cause but little wear of the material of which a road is constructed, but, if the surface is not well bonded, they rapidly wear out the road by displacing first the finer particles in the form of dust and later the larger mineral fragments which require this dust to hold them in place. This action is due to a shearing effect exerted upon the road surface by the wheels connected with the driving mechanism. A good bituminous dust preventive will hold the dust in place and, therefore, prevent such damage. When the road is subjected to any amount of heavy-teaming traffic, however, the heavily loaded steel-tired wheels cut through the surface mat of bituminous-bound material and cause rapid disintegration. This destruction

of the surface is also hastened by the cutting and pulling action of horses' hoofs when heavy loads are being drawn over the road. For such traffic the true road binders prove more satisfactory than the dust preventives.

USE OF BITUMENS IN ROAD CONSTRUCTION.

As has been stated, bituminous road binders are mainly employed in the construction and reconstruction of roads. They may be used in a variety of ways according to various conditions. They are most commonly applied in the construction of macadam roads according to two methods, known as the penetration method and the mixing method. In either it is sufficient to incorporate the binders with only the upper 2 or 3 inches of broken stone constituting the wearing surface. The foundation course of the road may be constructed as in ordinary macadam work, except that more attention should be paid to filling the voids between the larger fragments with stone screenings. No excess of screenings should, however, be left upon the surface of the foundation to interfere with its interlocking with the wearing course of bitumen-covered stone. Careful attention should be paid to this matter, otherwise a separation of the two courses may occur and lead to a breaking up of the wearing surface under traffic.

THE PENETRATION METHOD.

In the penetration method the wearing course of what is known as No. 2 broken stone is placed upon the foundation before the road binder is applied. The No. 2 stone usually runs from one-half inch to $1\frac{1}{4}$ inches in diameter, but, when the road stone is soft and easily crushed under the roller, larger sizes may sometimes be employed to advantage. This stone is laid to a depth of from $2\frac{1}{2}$ to $3\frac{1}{2}$ inches, and rolled until the stones interlock. A light coating of clean half-inch stone chips, free from dust, may then be applied and rolled into the surface, which should, however, never be completely filled. Sometimes this application of stone chips is omitted, particularly if the binder is a very heavy one and therefore difficult to incorporate in the wearing surface owing to its tendency to harden rapidly when brought in contact with the stone. The bituminous binder is always heated to a considerable degree of fluidity before being applied, and application is made either by hand directly from portable heating kettles or by means of specially constructed distributors, as in the case of surface treatment with the heavier bituminous dust preventives. Approximately $1\frac{1}{2}$ gallons of binder are thus consumed to every square yard of road surface. Clean stone chips are next applied in sufficient quantity to fill all surface voids and prevent the bitumen from sticking to the wheels of the roller,

and the road is then well rolled. The surface is finished off by applying a flush or seal coat of bitumen at the rate of from 0.3 to 0.5 gallon per square yard. This coat is then covered with a thin layer of stone chips, and the road rolled until firm and smooth.

The object of the penetration method is to produce a bituminous concrete wearing surface without incurring the time, labor, and, therefore, the expense of mixing. While the whole surface may be covered with comparatively little bitumen, a uniform penetration and distribution for a depth of two or more inches can not be secured with less than 1 gallon of bitumen per square yard, and usually 1½ gallons are required. If lasting results are expected, not less than 1 gallon should ever be applied. The seal coat of approximately one-half gallon of bitumen to the square yard is very desirable, as it protects the underlying thinner films from weathering and disintegrating. In some cases attempts have been made to construct a macadam road according to this method with a total of only a little over one-half gallon of bitumen per square yard. This amounts to nothing more than a surface treatment, and the bitumen can therefore be expected only to serve in the capacity of a semipermanent binder. Roads so constructed will usually require additional treatment at the beginning of the next dusty season. The main disadvantage of the penetration method of construction is the uncertainty of obtaining a uniform distribution of bitumen throughout the wearing surface. In spite of this objection, however, many excellent roads have been built by the method when carefully followed in all of its details. It has the advantage of being one of the cheapest forms of bituminous road construction, and should cost but a few cents per square yard plus the price of from 1½ to 2 gallons of bitumen, above that of ordinary macadam construction. In many cases, however, the cost of such work has been excessive because of the makeshift heating apparatus which has been employed.

THE MIXING METHOD.

The mixing method of constructing bituminous macadam is identical with the penetration method up to the completion of the foundation course. The wearing course, which is usually laid to a finished depth of 2 or 2½ inches, is composed of a more or less carefully graded broken-stone aggregate which has been previously mixed and coated with a hot bituminous binder. Sometimes the aggregate itself is heated before mixing, while sometimes it is used cold. In the former case a binder of high original consistency may be employed, while in the latter it should be considerably softer, and preferably a cut-back product containing a volatile flux. The mixture may be made either by manual labor or by machinery.

After the bitumen-coated stone has been laid to the desired depth, it is rolled either with or without the addition of a thin layer of half-inch stone chips, free from dust. When the latter can be done without the stone sticking to the roller wheels, a very satisfactory surface may be secured by the application of a light coating of bitumen-covered sand or stone chips, which is rolled into the surface voids and dusted over with fine stone screenings. In the former case all surplus of screenings should be broomed off and a flush or paint coat of bitumen applied in the same manner as described under the penetration method. Stone screenings are then applied and rolled down in sufficient quantity to take up any excess of bitumens on the surface. Under favorable conditions a macadam road constructed with a 2-inch top course of bitumen-covered stones should not cost over 6 cents per square yard, plus the cost of from 1.3 to 2 gallons of bitumen, above the cost of an ordinary macadam road of the same depth. Mechanical mixing when properly done is much preferable to hand mixing and should prove considerably cheaper under ordinary circumstances.

ROCK ASPHALTS.

Before leaving the subject of bituminous macadam construction, mention should be made of one other type known as the rock-asphalt macadam. Rock asphalts are sandstones or limestones more or less impregnated with maltha. They have been employed to a considerable extent in the surfacing of macadam roads, but all are not suitable for this purpose, as both the character and percentage of bitumen present vary within wide limits. Those which contain from 7 to 10 per cent of a viscous sticky maltha are the best for road construction. The rock should be crushed down until it consists of an aggregate of individual grains, each thoroughly coated with a film of bitumen, which should cause it to adhere firmly to the surrounding grains if subjected to pressure. This aggregate may then be used as a surfacing material in macadam construction.

The foundation of a rock asphalt macadam is prepared in the same manner as described under the penetration method. Upon this foundation should be spread a 2½-inch course of broken stone, preferably ranging from 1 to 2 inches in diameter. This course should be rolled only sufficiently to produce a smooth, even surface, and no attempt should be made to reduce the voids in any other manner. The rock asphalt should then be thrown on and raked over the surface to a uniform depth of one-half inch. This application is rolled into the upper course as thoroughly as possible and a second coat of the rock asphalt applied in the same manner, but to a depth of 1 inch. The road is then finished off by rolling until it is firm and well compacted.

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MANUFACTURED BITUMINOUS AGGREGATES.

Besides the three methods of constructing bituminous-bound roads which have been described there are a number of others, but all of less importance. Certain proprietary or patented mixtures of bitumen with a mineral aggregate can now be obtained for use in the construction of the wearing course of roads, and some of them have been quite extensively employed in the eastern part of the United States with excellent results. Most of these mixtures, while prepared with hot materials, can be shipped and laid cold. They are used in place of the No. 2 course in ordinary macadam construction. To prevent the individual particles from cementing together under their own pressure during shipment, damp sand is sometimes incorporated in the mixture. The mineral aggregate is carefully graded, and when laid and rolled, consolidates into a dense, well-bound wearing surface. Fluxed native asphalts, oil asphalts, and residual tars are employed as binders for the aggregates, and sometimes other ingredients, such as lime, are combined with the bitumen. Both crushed rock and crushed slag have been used for the aggregate, the latter principally in England. While these manufactured bituminous aggregates are very convenient for the road engineer to employ, their use is necessarily limited to the locality in which they are manufactured, as freight charges on long shipments raise their cost to a prohibitive figure.

CONCLUSION.

Bituminous road binders may be employed in the construction of earth and gravel roads as well as macadam roads, but it is the latter type which, at the present time, gives promise of the most satisfactory results. The bituminous macadam, if properly constructed, seems well adapted to withstand the combined action of automobile and horse-drawn traffic. It is firm, resilient, and waterproof, and is dustless in the same sense that an ordinary asphalt pavement is dustless. Much depends upon the character of the bituminous binder used, and it is most necessary that this binder be subject to examination and certain specific tests, as in the case of cement, iron, steel, and other structural material.

THE RESPIRATION CALORIMETER AND THE RESULTS OF EXPERIMENTS WITH IT.

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INTRODUCTION.

The study of many practical and everyday problems having to do with the nutrition of man and animals, as well as the investigation of a great number of complex problems pertaining to the subject, necessitate the accurate measurement of the income and outgo of matter and energy in the body of man or animals. From time to time various methods have been proposed for accomplishing this end, and apparatus of a variety of types which would measure one or more of the desired factors has been devised.

It is generally conceded that the respiration calorimeter devised and perfected by Atwater and his associates in connection with the nutrition investigations of the Office of Experiment Stations adequately meets the requirements of the case, and that the perfecting of that apparatus marks a great advance in experimental physiological methods. This achievement is the more valuable since the usefulness of the respiration calorimeter is not limited to experiments with man, for the apparatus can be modified to fit it for experiments with animals, or, indeed, for other purposes in which it is desirable to measure such factors as gaseous exchange and heat production. The fundamental principles involved in the construction of the respiration calorimeter and the development of the apparatus during varying phases have been discussed in technical publications of the Department of Agriculture and many experiments carried on with the respiration calorimeter have been reported.

For many years the policy of cooperation with agricultural colleges and experiment stations and other suitable institutions was followed in conducting the Department nutrition investigations, and under this plan the respiration calorimeter work was carried on in the chemical laboratories of Wesleyan University, Middletown, Conn. The results obtained in these and later experiments have been published in numerous bulletins and reports.[1] It is perhaps not too much to claim

[1] For list of publications see U. S. Dept. Agr., Office Expt. Stas. Circ. 89.

that this plan of cooperation had a widespread effect in stimulating interest in the study of nutrition problems in the United States, and in calling the attention of students of agriculture to the need for studying problems pertaining to the rational utilization as human food of agricultural products of animal and vegetable origin.

The years from 1886, when the work was begun, to 1906 mark the period of cooperative work in the Department of Agriculture nutrition investigations, for at the latter date it was decided to centralize the work in Washington, and quarters were provided for the respiration calorimeter in the new building of the Department of Agriculture. In reconstructing the respiration calorimeter it seemed advisable not to modify the general lines on which it had been originally built, but improvements in detail were introduced which make for simplicity and convenience of operation as well as for increased accuracy. Briefly speaking, the improvements consist in the use of more efficient materials, particularly for heat-insulation purposes, more rigid construction, simpler and yet more efficient methods of controlling experimental conditions, and improved methods of recording experimental data, which include automatic devices. In the following pages the calorimeter in its present form is described, and the results of some experiments with it are presented which are a part of work more recent than that summarized in an article in an earlier Yearbook of the Department.[1]

PLAN AND CONSTRUCTION OF THE RESPIRATION CALORIMETER.

A respiration calorimeter is an instrument of precision which includes an air-tight and heat-tight chamber in which the subject remains during the experiment, and accessory apparatus for measuring and recording the experimental data. The chamber must be of a size suitable for the purposes of experimental work for which it is designed, and provided with devices for maintaining a ventilating air current, for removing and determining the amount of the products of respiration, for supplying oxygen to the air current to replace that withdrawn by the subject, and for carrying from the chamber and measuring the amount of the heat liberated by the subject as a result of muscular work, either internal or external, which has been performed. Convenient arrangements must also be made for supplying the subject with food, for collecting the liquid and solid excreta, and for determining body temperature, respiratory movements, and other similar factors, should the experimental conditions necessitate such measurements. In addition, provision must be made for full analyses of food and excretory products, including determinations of heats of combustion, and for the study of special factors determined by the character of the experiment.

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[1] U. S. Dept. Agr. Yearbook 1904, p. 205.

Briefly expressed, the respiration calorimeter is an instrument which permits of the measurement of income and outgo of matter and energy in the subject and of numerous other factors which are of value in drawing deductions regarding physical and physiological activities. The apparatus is complicated, and the experimental data recorded are highly technical, nevertheless problems of everyday interest can be studied and results obtained which are of very practical as well as of theoretical value.

The respiration calorimeter recently installed at the Department of Agriculture is of a size suitable for experiments with man under a variety of conditions, and includes such accessory apparatus that it may be employed in the study of a great variety of problems pertaining to agricultural questions of special interest in connection with lines of work carried on by the Department.

During an experiment the subject spends his time in the respiration chamber, which is metal-walled and is 6½ feet long, 6½ feet high, and 4 feet wide. The chamber has double walls, the inner one copper and the outer one zinc. Though rather small, as necessary for experimental purposes, the chamber is nevertheless large enough for the subject to be comfortable, even during an experiment covering several consecutive days. An opening in the side closed by plate glass sealed in place during an experiment serves as the door and window, admitting ample light for reading and writing. Another opening, with a trap on each end, is used to pass articles into or out of the chamber. Attached to the walls of the chamber are metal hooks for clothing and metal shelves for books, food receptacles, and the like. The furniture, which varies somewhat with the nature of the experiment, includes a chair, a table, and a cot, and when the subject is to perform muscular work a special form of bicycle ergometer. A telephone is provided for communication between the subject inside and the investigator outside the apparatus. In fact, every effort is made to provide for the comfort of the subject under the experimental conditions, and no one has found his sojourn in the apparatus especially irksome.

The metal walls of the chamber are air-tight. That the air of the chamber may be continually changed, it is drawn out through a pipe at one end and returned through a pipe in the other end, a circulation of 75 liters per minute being maintained by means of an electrically-driven blower. The air coming from the chamber is passed through purifiers to remove the moisture and carbon dioxid given off by the subject, while to the air returning to the chamber is added oxygen to replace that used by the subject.

The heat given off by the subject within the chamber is removed by a current of cold water passing through a small brass pipe suspended

near the chamber ceiling, the heat-absorbing area of the pipe being increased by copper disks soldered to it. This method of removing heat from the room is simply the reverse of the one commonly followed in warming a house in winter time by bringing warm water into a radiator from which the heat may be delivered into the room. By regulating the temperature of the water that flows through the heat absorber and the rate at which it flows, the absorption and removal of heat from the respiration chamber may be controlled to such an extent as to maintain a constant temperature of the air in the chamber. There is an automatic device for maintaining the temperature of the flowing water constant at any point for which it may be set. Another device gives an automatic record of the difference between the temperature of the water just as it enters and just as it leaves the heat absorber. The quantity of water that flows through the absorber is weighed and the weight for any period, multiplied by the average temperature difference for the period, is the quantity of heat carried out of the chamber by the flowing water, expressed in calories, one calorie being the amount of heat necessary to raise 1 kilogram of water 1° C.

The air of the chamber is constantly stirred by a small electric fan to equalize its temperature. To determine the temperature of the air, electric resistance thermometers are used, six resistance coils joined in series being distributed on the walls of the chamber in such a way as to indicate the average temperature conditions.

Surrounding the copper wall of the chamber and about 3 inches away from it, is a parallel wall of zinc. If the temperature of the zinc wall is kept the same as that of the copper wall, there will be no passage of heat through the walls of the chamber in either direction. In order to accomplish this, outside of the zinc wall and about 1½ inches from it, is a covering of cork board 1½ inches thick. The cork board is protected by the outer wall of the apparatus, which is made of a kind of asbestos board bound together with strips of brass. The space between the zinc wall and the cork board is provided with resistance wire carried on insulators attached to the zinc, and brass pipe carried on small iron hooks attached to the framework supporting the zinc. By passing a current of electricity through the resistance wire the air in the confined space may be heated, and by passing a current of water through the brass pipe the air may be cooled. In this way the temperature of the zinc wall may be raised or lowered at will.

The temperature of the zinc wall is controlled in accordance with that of the copper wall, that there may be little or no difference between them. To detect temperature differences, use is made of thermo-electric elements attached between the two metal walls in such a way that one end of the element lies close to the copper

wall and the other end lies in the plane of the zinc wall. There are 95 of such thermo-electric elements scattered about the walls, equally distant from each other, and connected in series with each other and with a delicate galvanometer, in such a way that temperature differences between the two walls may be detected independently for the top, upper half of the sides, lower half of the sides, and the bottom of the chamber, and for all 95 points together. The deflection of the galvanometer in one direction indicates that the zinc wall is warmer and in the other direction that it is colder than the copper wall and needs cooling or heating accordingly. The air space surrounding the zinc wall is therefore heated or cooled in order to keep these deflections as near the zero point of the galvanometer as possible. This device is so sensitive that an average temperature difference of one two-thousandth of a degree between the two metal walls as a whole would cause an appreciable deflection by the galvanometer. By keeping the deflections near zero the average temperature difference between the two walls is therefore insignificant.

By means of electrical resistance coils attached in close thermal contact with the copper at different points within the chamber and connected with a temperature-indicating device outside the chamber, the actual temperature of the copper wall is ascertained. In connection with the investigations with this apparatus it is essential to know whether the body temperature of the subject has increased or decreased during the experimental period. In some cases the temperature of the body is ascertained by means of a clinical thermometer inserted under the tongue or in the armpits, but preference is given to electric resistance thermometers, one form of which may be attached to the surface of the body, and another form of which may be introduced into the large intestine, which, connected with a temperature-indicating device read by the investigator, furnish a record of body temperatures accurate to one one-hundredth of a degree, for a practically continuous period, since the interval between the readings is very short.

The illustrations (Pls. XXI and XXII) show the general appearance of the respiration calorimeter with part of its accessory apparatus and give an idea of the way it is constructed.

In figure 1, Plate XXI, which shows the respiration calorimeter during the process of construction, the outer metal (zinc) wall of the respiration chamber is seen and the iron framework which supports the apparatus and makes it rigid. Near the opening in the side wall, which serves as a window and door, may be seen the projecting ends of the small tubes through which will pass the pipes which carry in and out of the chamber the ventilating air current, and the water current which takes up and carries out for measurement the heat (energy) liberated by the subject. To the iron framework

surrounding the chamber the outer wall of asbestos board lined with cork board seen in figure 2, which insulates and protects it, is attached.

Figure 2, Plate XXI, shows the respiration calorimeter and accessory apparatus during an experiment. The observer, who reads the galvanometer, regulates the temperature of the outer metal wall of the respiration chamber, and attends to other experimental details, sits at the "observer's table" on the "observation platform." The window door, through which the subject enters the respiration chamber, may be noted in the calorimeter wall at the left and behind the observer, and near the observer and close to the outer walls of the calorimeter may be noted the numerous pipes which carry the ventilating air current to and from the respiration chamber, and those which convey the water current which takes up the heat generated in the chamber and carries it out. In front of the observer on the hanging support is the galvanometer, which is used in obtaining data for regulating the temperature of the calorimeter walls and for reading the electrical thermometers, giving the temperature of the interior of the chamber.

At the left of the picture may be seen one of the experimenters, who is standing near the air lock in one of the end walls of the apparatus, through which food in glass jars or other suitable receptacles is passed to the subject in the chamber. At the right of the picture and in front of the observer may be seen the "absorption table" with two shelves. On this table are placed the blower which forces the ventilating air current through the chamber, the apparatus for removing carbon dioxid and water from the outgoing air current, the device for adding oxygen to the ventilating air current, and other devices which have to do with the ingoing and outgoing air current. At the left of the picture and behind the observer's platform may be noted the large cylindrical container in which the water is collected which carries out heat (energy) liberated in the respiration chamber by the subject. It stands on scales in order that the amount of water may be conveniently weighed and is provided with appliances by which it may be emptied as occasion requires.

Figure 1, Plate XXII, shows the device for the automatic control of the temperature of the water entering the heat-absorbing system. The water is brought to this apparatus cooler than is desired, and is heated by an electric current passing through resistance wire. The strength of the current is controlled by means of a water rheostat in which a carbon plate, which may be seen just above the top of the tank, is moved up and down to increase or decrease the resistance in the heat circuit. The movement of this carbon plate takes place automatically with every change of 0.05° above or below the temperature at which the dial is set automatically in accordance with the movement of the needle of a galvanometer.

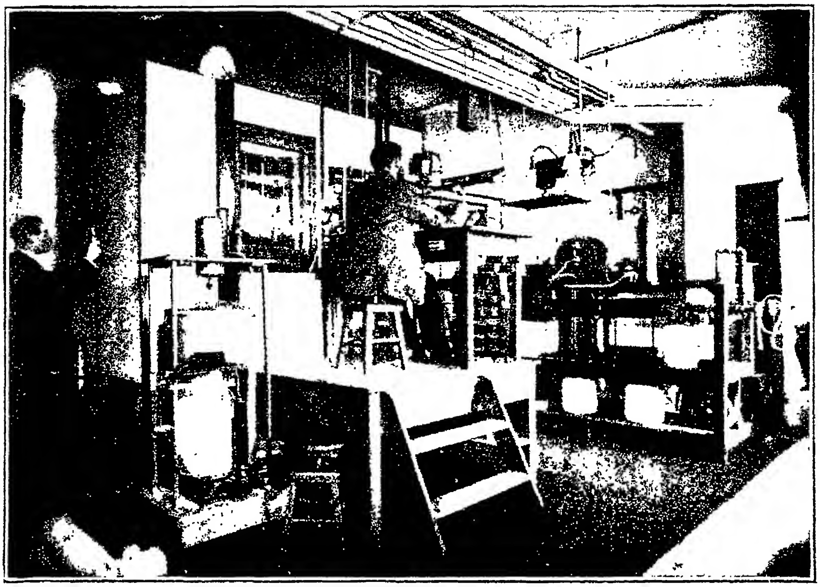

FIG. 1.—RESPIRATION CALORIMETER IN USE FOR AN EXPERIMENT.

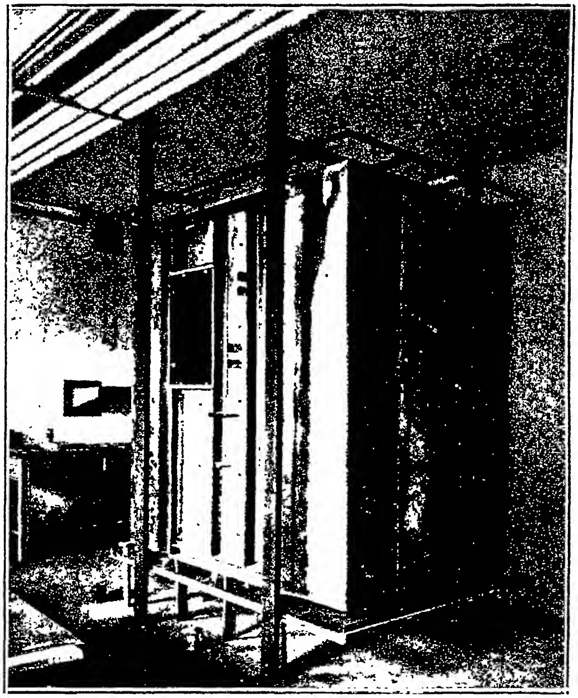

FIG. 2.—RESPIRATION CALORIMETER DURING CONSTRUCTION.

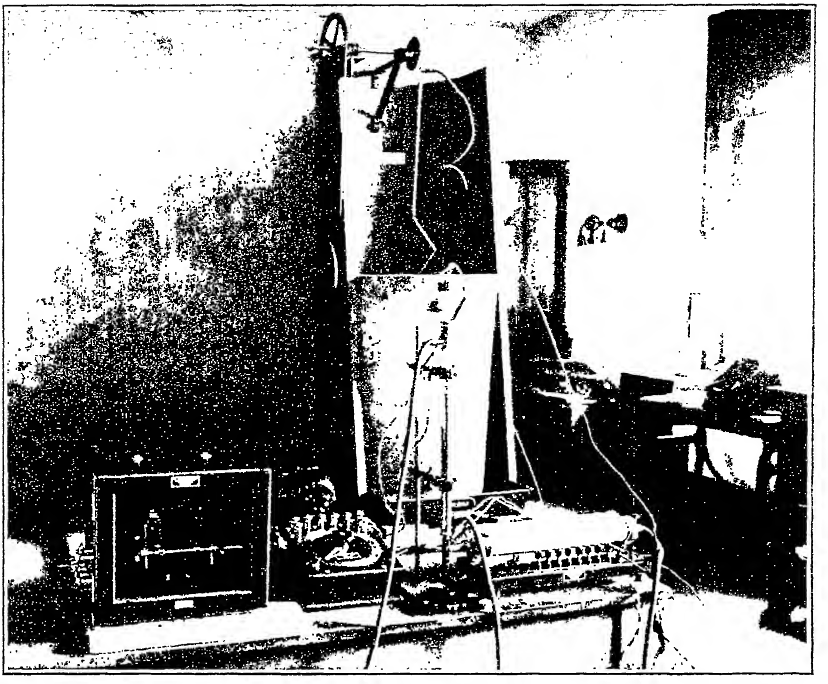

FIG. 1.—DEVICE FOR AUTOMATIC CONTROL OF TEMPERATURE OF WATER ENTERING HEAT-ABSORBING SYSTEM.

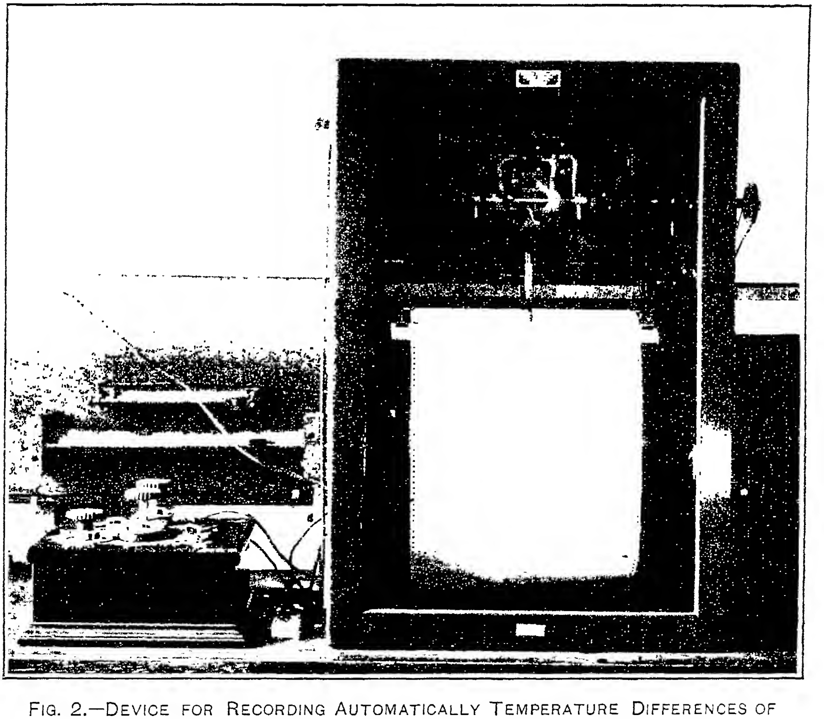

FIG. 2.—DEVICE FOR RECORDING AUTOMATICALLY TEMPERATURE DIFFERENCES OF WATER ENTERING AND LEAVING HEAT-ABSORBING SYSTEM.

Figure 2, Plate XXII, shows the automatic recording device referred to above. The paper moves forward at a rate of 3 inches per hour and the pen point makes a mark in red ink on the moving paper. The position of the pen changes with every change of 0.01° in the difference between the temperature of the water entering and the water leaving the heat-absorbing system.

In investigations conducted with the respiration calorimeter at the Department of Agriculture, the experiments are made with normal subjects in good health and under controlled conditions with respect to diet, muscular activity, and other factors pertaining to the question studied. A given experiment, according to its nature, may continue from a few hours to several days. With the respiration calorimeter and accessory chemical and physical apparatus, the complete intake of chemical elements and energy in food, drink, and air, and the complete output of elements and energy in gaseous, liquid, and solid excretory products by the body may be ascertained. Proper consideration of these data shows whether the body has gained or lost material or has produced more energy than it has received under the experimental conditions, and from these and other observed facts, conclusions can be drawn with reference to the questions studied.

From the large amount of data available as a result of experiments with the respiration calorimeter some topics have been selected for discussion in the following pages which it is believed are of general interest and which will serve to show something of the range of subjects which it is possible to study with this apparatus. Of the experiments summarized, those which deal with the efficiency of the human body as a machine and with the energy of mental as compared with muscular work are technical, while the studies of the relative ease of digestion of cheese and meat in quantities such as are ordinarily consumed are of general interest in connection with the discussion of everyday questions of diet.

MUSCULAR WORK AND BODILY ACTIVITY.

A small portion of the food eaten is utilized by the body for the building and repair of tissue and the performance of physiological functions in general, but by far the larger part of the food is used as a source of energy for the performance of muscular work, both internal and external, and it is commonly stated also for maintaining body temperature. There is reason to believe, however, that within ordinary temperature limits at least, the body maintains this temperature by utilizing heat resulting as a by-product from the performance of muscular work. The main function of the food, then, is to enable the body to perform muscular work.

The source of the power obtained from an engine is the fuel burned under its boiler, and in the same way the source of the energy which the

body uses for work of all sorts is found in the food consumed. The theoretical energy values of all ordinary food materials have been determined by laboratory methods which are similar to those used for determining the theoretical energy values of coal and other sorts of fuel. Only a part of the energy of the fuel burned under a boiler is available for mechanical work, the efficiency of an engine being dependent upon the kind of fuel used, the principles of construction followed in building the engine, and other factors. The problem of determining the efficiency of an engine—that is, how much of the theoretical energy of the fuel is available for mechanical work—is a matter of great importance. It is equally interesting to ascertain the efficiency of the living engine—the body—and to ascertain the extent to which it converts the energy of food into effective muscular work. This problem has been studied with the respiration calorimeter and important data have been secured.

One piece of apparatus used in experiments with the respiration calorimeter is known as the bicycle ergometer, because it is built somewhat like a bicycle to utilize the powerful leg muscles, and because by its use the activity of the subject may be controlled and a very accurate measure may be obtained of the amount of muscular work actually performed. The subject of the experiment works upon this apparatus in the chamber of the respiration calorimeter and his output of carbon dioxid, water, and heat, and his consumption of oxygen are very carefully measured. These same factors are also determined for the same subject in other experiments in which no muscular work is done on the ergometer. From the data for heat production thus obtained, the efficiency of the subject can be ascertained.

This may be done in two ways. For example, with one subject, while doing muscular work on the ergometer, the total heat production in six tests averaged 339 calories per hour and the heat equivalent of the work done in the same tests averaged 49 calories per hour, the latter value being 14.5 per cent of the former. The mechanical efficiency of the subject might be said to be 14.5 per cent. On the other hand, a part of the total heat produced by the subject would be eliminated whether he was working or resting, so it would seem fairer to make allowance for that. With this subject it was found that while he was doing no work on the ergometer his heat production in four tests averaged 112 calories per hour. If this quantity be deducted from 339 calories of total heat produced, the difference, 227 calories, would represent the heat production actually due to the performance of the work. On this basis the 49 calories of work done would represent a mechanical efficiency of 21.6 per cent.

In 30 such tests with 5 different subjects the efficiency was 18.1 per cent in one case. The averages of the separate tests with the different individuals ranged from 20.7 to 21.6 per cent, and the general

average for all of the tests was 20.8 per cent. While there were some differences in individuals with respect to this factor, the agreement in all cases was sufficient to warrant the assumption that the efficiency of the average man performing muscular work is at least 20 per cent.

In this respect man compares very favorably with the best steam engines. It is safe to say that the average efficiency of these does not exceed 14 per cent. Some types of internal combustion engines develop an efficiency of more than double that, but they are at present exceptions. Moreover, in the case of the steam engine there appears to be a certain rate of work at which it will develop its greatest efficiency, but in the case of man it was shown that with one subject at least an increase in the load did not materially affect the efficiency of the body as a machine. Under all conditions of work it was found with this subject that about 21 per cent of increased heat production due to muscular work was represented by the heat equivalent of the muscular work performed.

To state the matter in another way, these figures mean that for every calorie of work the body performs it must be supplied with 5 calories in its food.

MENTAL WORK AND BODILY ACTIVITY.

It is of general as well as of scientific interest to ascertain to what extent mental activity compares with muscular activity with respect to the bodily transformation of matter and energy attendant upon it. Severe or prolonged mental effort commonly results in a feeling of fatigue resembling that produced by muscular effort, and experiments have shown that mental exertion results in both psychic weariness and loss of muscular power. It was quite natural to suppose, therefore, that mental work resembled muscular work in character and was followed by actual physical exhaustion.

Strangely enough, however, there is apparently no corresponding transformation of matter and energy by the body in the two cases. During the course of investigations with the respiration calorimeter, reported in detail in a recent bulletin [1] of the Department, an interesting study of this question was made. A college student took an examination that required considerable mental effort, in the chamber of the apparatus, and the elimination of carbon dioxid, water, and heat, and the consumption of oxygen were measured. Subsequently, the same factors were measured for the same student during a corresponding period in which all the conditions except that of mental work were as nearly as possible identical with those during the examination period. The work was repeated with other students

[1] U. S. Dept. Agr., Office Expt. Stas. Bul. 208.

and altogether 22 such experiments were made and the averages of the results obtained with them were as follows:

Hourly output of matter and energy in periods with and without mental work.

Hourly excretion of—	With mental work.	Without mental work.
Carbon dioxid.... grams..	33.4	32.8
Water.... do....	27.3	25.9
Oxygen.... do....	39.2	37.8
Heat.... calories..	98.8	98.4

In connection with these same experiments data were obtained regarding pulse rate and body temperature also. The results of the experiments summarized indicated that the pulse rate was slightly increased, the body temperature was somewhat higher, the output of water vapor was about 5 per cent, that of carbon dioxid about 2 per cent, and that of heat about one-half of 1 per cent greater, and the oxygen consumption about 6 per cent greater, during the "mental work" period. As a whole, however, the increases were in general small and the exceptions were rather numerous. For instance, more than half of the students produced more heat in the period without mental exertion than in the "mental work" period. A fair interpretation of the results obtained with these students, therefore, would be that in these instances at least sustained mental effort had no positive influence upon the transformations of matter and energy within the body.

THE RELATIVE EASE OF DIGESTION OF DIFFERENT FOODS.

Since the body derives all of its energy from its food, it is important to know how foods compare with each other as sources of energy, just as it is to the engineer to compare different kinds of coal or other fuel. The purpose of investigations at present conducted with the respiration calorimeter is to determine the value of different agricultural food products, both animal and vegetable, as sources of energy for muscular work. One factor affecting such value is the energy required for the digestion, absorption, and assimilation of the food by the body in preparing it for utilization before its energy can be effectively applied, since this reduces the proportion of the total potential energy of the food that may be applied to effective muscular work. Furthermore, two kinds of food may be identical with respect to the total potential energy an equal amount of each will supply, but may differ with respect to the amount required for digestion and other functions by which the energy is rendered available. If the difference between the two materials is

considerable, this might have some economic significance in comparing them as sources of energy for muscular work.

Studies of this particular question are being made with the respiration calorimeter at the present time. Some of the results obtained in recent experiments in which meat and cheese were compared with each other in this respect are interesting. To make these experiments, the subject was put in the chamber of the respiration calorimeter and given a diet consisting in large part of beef, the meat being supplemented by a given amount of crackers and milk. In other experiments the same subject was given the same quantities of crackers and milk supplemented by an amount of cheese equivalent in nutritive value to the amount of meat eaten in the preceding experiments. In all cases the heat production by the subject during a period in which the diet was being digested was very carefully measured. In the experiments with the meat diet the subject produced 82 calories of heat per hour during the digestion period and in those with the cheese diet 84 calories per hour. From results of experiments obtained with this subject, it seems fair to believe that there was practically no difference between the cheese and the meat with respect to ease of digestion, at least in such quantities as are commonly eaten.

Such a conclusion is of much interest since—taken in connection with the results of extended work also carried on as a part of the nutrition investigations of this Department, which show that cheese of different sorts and made and cured in various ways is very thoroughly assimilated and on an average without physiological disturbance—it furnishes experimental proof of the contention that cheese is a foodstuff suitable for general use in the diet and not simply as a condimental foodstuff chiefly valuable for the special flavors which it possesses.

CONCLUSIONS.

In the foregoing pages the respiration calorimeter installed at the Department of Agriculture has been described, the purposes for which such an instrument is useful have been discussed, and some of the important results which have been secured in recent experiments with it have been summarized.

As regards construction, the distinguishing feature of the respiration calorimeter is an air-tight and heat-tight metal-walled chamber with outer insulating walls, which is of a size suitable for experiments with man. The chamber is equipped with conveniences so that the subject may remain in it for long periods if need be. Air circulation through the apparatus is provided for, the respiration products being removed and oxygen added as required. The respiratory products and other excretory products are measured and analyzed in comparison with the food supply, the oxygen consumption is determined,

and also the total energy (i. e., heat) output of the body. With this apparatus it is therefore possible to study the complete balance of income and outgo of matter and energy in the body, to measure the respiratory quotient—that is, the ratio between oxygen consumption and carbon dioxid excretion—and to study other indexes of body change. Control tests have shown that even in experiments of long duration the measurements which are made are as accurate as those obtained in the analysis of small quantities of material by the usual laboratory methods. It seems fair to conclude that the respiration calorimeter is to be regarded as an instrument of precision, useful for the study of everyday problems as well as those of scientific interest.

Back of all practical applications there must be scientific work if the conclusions are to endure, and this is true of agriculture as of other branches of science. The investigator very commonly bases his conclusions upon the changes which take place when the chemical substance, or the plant, or the animal which he is studying is observed under controlled experimental conditions. It is because this is the case that the respiration calorimeter is of so much importance. It affords a method of measuring and recording a large number of experimental factors which render it valuable for studying many matters of importance in connection with the utilization as food of agricultural products of different sorts and a great variety of other problems important in connection with the work of the Department of Agriculture.

INCREASED YIELDS OF CORN FROM HYBRID SEED.

By G. N. Collins,
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INTRODUCTION.

During the past decade plant and animal hybrids have been very carefully studied. As a result of these studies it has been clearly shown that the individuals which are the immediate result of a cross behave in an entirely different manner from the progeny of the crossed individuals, and that one peculiarity of these first-generation hybrids is almost invariably a stronger constitution and increased vigor.

In many lines of animal breeding it is coming to be well understood that where maximum vigor and rapidity of growth are prime requisites it is often advantageous to cross two distinct varieties. The same principle holds with plants, but it has failed of commercial application except in the case of a few fruits in which valuable crosses have been achieved more through accident than design. As fruits are usually propagated by budding or grafting, the crosses are preserved in the first generation. It is only in recent years that breeders of either plants or animals have been brought to realize that this increased vigor is largely confined to the immediate result of the cross, and that when the crossed individuals are again bred among themselves or with either parent stock the vigor is soon lost. Recognition of the exceptional vigor of first-generation hybrids has usually resulted only in arousing the hope that a superior variety of hybrid origin might be established and fixed so that it could be propagated by seed. The possibility of the immediate utilization of first-generation hybrids has commonly been overlooked.

Among animals the hardy constitution of the mule has long been appreciated, and in this case the sterility of the cross has compelled the repeated production of first-generation hybrids. Had it been possible to breed the mules it is probable that the characters of the ass and horse would have become hopelessly mixed and diluted, and that a mongrel race inferior to either of the parent stocks and lacking the strong constitution of the mule would have resulted.

The utilization of first-generation hybrids should not be taken as a warrant for indiscriminate crossing or the relaxation of selection.

Intelligent selection applied to the parent varieties will without doubt be an important factor in securing the highest performance in the hybrid. Improved varieties are most precious heritages, and to allow them to deteriorate through indiscriminate crossing may result in irreparable loss. The Mosaic law, "Thou shalt not let thy cattle gender with a diverse kind; thou shalt not sow thy field with mingled seed,"[1] viewed in the light of recent knowledge, is still a wise injunction, and is instructive as showing the great antiquity of the practice of plant and animal breeding. While the importance of maintaining superior strains must not be lost sight of, advantage can now be taken of the further increase that may be secured by the intelligent crossing of two such selected strains.

There are many reasons why this apparently obvious method of increasing the yield of crop plants has been so tardy of application. With many crop plants the crossing is not easily accomplished and, although the yield from the crossed seed may be considerably greater, the labor and expense of producing such seed prevents the commercial application of the method.

Of the field crops grown for seed, corn is, perhaps, the only one to which the plan of utilizing first-generation hybrids is readily applicable. The method is so easily applied to this crop and the increases obtained are so important that one looks in vain for an adequate reason why the principle has not become recognized and generally applied.

That the yields of corn could be increased by crossing different strains was demonstrated as early as 1878 by the experiments of Dr. W. J. Beal, then professor of botany in the Michigan Agricultural College. His experiments were skillfully planned and carefully carried out. They were announced in the annual reports of the Michigan State Board of Agriculture, and further brought before the public by articles in the Farmers' Review.

The time, however, was not ripe for the appreciation of the fact by the public or by other experimenters. At that date even the value of careful seed selection was not generally appreciated and commercial fertilizers were only beginning to come into popular use. The margins of profit in agricultural operations were not as close as at present, and under these conditions an experiment showing that by the simple expedient of crossing two strains of a variety increases as high as 50 per cent could be secured passed unheeded.

No less than four times during the thirty years following Dr. Beal's experiments the possibility of increasing the yield of corn by the crossing of two varieties was independently demonstrated, and each time without knowledge of previous demonstrations. The uniformly favorable results of these experiments when brought together

[1] Leviticus, xix, 19.

preclude all question of accident or experimental error and show the method to have a very wide application.

PECULIAR HABITS OF THE CORN PLANT.

INABILITY TO ENDURE SELF-FERTILIZATION.

The corn plant differs from other crop plants in two fundamental particulars which make the utilization of hybrid seed especially applicable to this crop.

It is a well-known fact that seed corn which results from fertilizing the silks with pollen from the same plant will produce weak and unproductive plants. All experiments thus far have shown this rule to be without exception. It was thought that hybrid plants which had resulted from crossing very diverse types of corn might perhaps tolerate self-fertilization for one or two seasons without showing signs of deterioration. This was found by experiment not to be true. In a comparison of self-pollinated and cross-pollinated progenies in the second generation of hybrids made by the Department of Agriculture the self-pollinated rows were in every case distinctly inferior to the cross-pollinated rows of the same hybrid.

This important peculiarity of corn has not been kept sufficiently in mind in the effort to improve the crop. Methods of breeding adapted to other crop plants are entirely inapplicable to corn because of this peculiarity. The increased vigor of first-generation hybrid plants may be looked upon as the result of fully meeting this natural requirement of the plant for cross-fertilization, though other plants not so intolerant of self-fertilization show a similar increase in vigor when two varieties are crossed.

MALE AND FEMALE FLOWERS BORNE ON DIFFERENT PARTS OF THE PLANT.

That the male flowers producing the stamens and pollen are borne upon the tassel at the top of the plant and that the female flowers bearing the pistils and producing the seeds are borne at the lower nodes is, of course, well known to every one familiar with the corn plant, but the important advantage which this arrangement affords seems not to have been appreciated. With other crops belonging to the grass family the stamens and pistils are produced in the same flower or flower cluster, and to secure hybrid seed it is necessary for the breeder to perform the somewhat delicate operation of emasculation and to apply the pollen to the stigmas by hand, laboriously hybridizing one seed at a time. In corn the separation of the flowers makes it easy to produce hybrid corn seed on a large scale. It is only necessary to plant in alternate rows and remove the tassels of the female parent, as described later.

YIELDS OF FIRST-GENERATION HYBRIDS.

The early experiments on which the assurance of increased yields was based are discussed in Bulletin 191 of the Bureau of Plant Industry, United States Department of Agriculture. A summary of the experiments there described is as follows:

Dr. W. J. Beal (Michigan, 1878–1880) in two crosses very carefully compared with the parent varieties secured an increase in both cases, the average increase being 31 per cent.

An additional cross made by Beal in 1882, and compared with the best parent, exceeded that parent by 21 per cent.

Prof. C. L. Ingersoll (Indiana, 1881), in a cross between two strains of the same variety, showed an increase as compared with the male parent of 95 per cent.

Prof. J. W. Sanborn (Maine, 1889) in one cross secured an increase over the average of the parents of 41 per cent.

Morrow and Gardner (Illinois, 1892) secured increases in eight out of nine crosses, the average increase of the hybrids over the parents being 11 per cent.

Dr. G. H. Shull, of the Carnegie Institution Station for Experimental Evolution (New York, 1908), by crossing two self-fertilized strains of the same variety secured an increase over the original mixed stock of 2 per cent.

Dr. E. M. East (Connecticut, 1908) secured increases in all of four crosses, the average increase being 73 per cent.

Experiments conducted by the United States Department of Agriculture (Washington, D. C., 1909) with numerous primitive imported types crossed with one another and with United States varieties gave increased yields in fourteen out of sixteen cases, the average increase being 53 per cent.

To these experiments there can now be added from the results of last season's work the following evidence:

Five hybrids made at Victoria, Tex., in the season of 1909, by Mr. John H. Kinsler, of this Department, were compared with their parents in 1910. The varieties were planted in rows 200 feet long and the series thrice repeated. The average yield of the five hybrids was 9 per cent greater than the average of the pure strains. The most favorable cross produced 34 per cent more corn than the average of its parents. In four of the five hybrids the yield exceeded that of either parent.

In addition to the increased yields the results of the experiments in Texas demonstrated the possibility of utilizing the more highly bred northern strains in combination with local varieties. In the high-yielding northern varieties the husks have been so reduced that they do not afford sufficient protection to the ears under Texas conditions,

and though in most cases the yield of these northern varieties will exceed that of the less specialized local forms the high percentage of damaged corn precludes their utilization.

In first-generation hybrids between northern and Texas varieties, experiments indicate that the ears are almost as well protected in the hybrids as in the pure Texas varieties. In four first-generation hybrids, between northern varieties and a Texas variety with well-protected ears, the proportion of damaged ears ran from 3.5 to 9.3 per cent, with an average of 6.8 per cent. The proportion of damaged ears in the Texas variety used as the female parent was 3.2 per cent, while the average proportion of damaged ears in 11 plantings of northern varieties was 22.7 per cent, the extremes being 14.2 and 36.2 per cent.

METHOD OF PRODUCING HYBRID SEED.

To produce hybrid seed it is necessary that the pollen of one variety shall fall on the silks of another variety. Where only small quantities of seed are required, as for experimental purposes, the simplest method is to inclose the ears before the silks appear, and the tassels before they begin to shed pollen, in strong paper bags secured by soft copper wire. The bags placed on the tassels will soon contain a quantity of pollen, which should be dusted on the silks after they have protruded 2 or 3 inches from the tip of the ear. As soon as the ears are pollinated the bags should be replaced to protect them from foreign pollen. A second or a third application of pollen at intervals of a day or two may be necessary, in order to secure complete pollination.

The relatively large quantity of seed that is secured from a single pollination makes the production of hybrid seed by this method practicable, even where considerable quantities of seed are required. One person, working three hours a day for three days, should secure two or three hundred hybrid ears. Selecting these down to one-fourth, the remaining 50 or 75 ears should plant from 4 to 6 acres. The opportunity for selection is greater than might appear, since only vigorous and well-formed plants will have been bagged.

Where larger quantities of hybrid seed are desired it can be produced still more economically by planting the two varieties that are to be used as parents in alternate rows and removing all tassels as they appear in the rows of the variety to be used as the female parent. All the pollen produced in the field will then be from the variety chosen for the male parent, and all seed on the detasseled plants will be hybrid. To insure the purity of the hybrid seed it is necessary to have the hybridizing field sufficiently removed from other fields of corn to prevent any pollination from outside sources. This method has the further advantage that pure seed of the male-parent variety

is produced on the plants that were not detasseled, and selections can be made for planting the hybridizing plat for the next season.

COST OF PRODUCING HYBRID SEED.

It has been repeatedly demonstrated that the labor and expense necessary to select and cross-fertilize seed corn is more than repaid by the increased yields. It can now be shown that the slight additional effort necessary to secure hybrid seed of two varieties is also a paying operation.

In the growing of corn the cost of seed is ordinarily less than 2 per cent of the total cost of producing the crop. Though hybrid seed should cost double the price of ordinary selected seed, an increase of 1 or 2 per cent with a fair crop would more than repay the additional expense of hybridizing. Where increases ranging from 5 to 50 per cent may be expected, there are few farm operations that yield such large returns.

It may help to bring the matter home to illustrate by an example: Assuming a yield of 40 bushels per acre, which, though somewhat above the average yield for the United States, is below the average of growers who pay close attention to the choice of seed, and taking the average price of corn as 45 cents a bushel, the gross returns from an acre would amount to $18. The total average cost of producing an acre of corn has been calculated for Minnesota conditions as approximately $10.50.[1] Suppose, now, an increase of only 10 per cent by the use of hybrid seed, raising the yield to 44 bushels per acre. The gross receipts would be raised to $19.80, the additional cost of harvesting would amount to 35 cents an acre, and the additional cost for hybrid seed, estimated at double that of ordinary seed, would be 23 cents to the acre, raising the total cost of production to $11.08, and leaving a profit of $8.72 per acre as against $7.50.

There is a popular belief in many parts of the country that the planting of two varieties in alternate rows increases the yield the same year. Recent experiments have shown that this belief may have a warrant in fact, but such an increase should not be confused with that obtained in the next year by the planting of the hybrid seed.

In experiments with a recently introduced variety of corn from China it was found that the use of pollen from another variety resulted in an increase of the size of the seed by about 20 per cent.[2] The seeds of this Chinese variety are very small, and the increased size might have been due to an immediate expression of the large

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[1] Bulletin 117, University of Minnesota; and Bulletin 73, Bureau of Statistics, U. S. Department of Agriculture.

[2] A New Type of Indian Corn from China. Bulletin 161, Bureau of Plant Industry, U. S. Dept. of Agriculture, p. 18, 1909.

seed characteristic of the male parent. On the other hand, it seems not improbable that the vigor imparted by crossing should make itself apparent at once by increasing the size of the seed. The embryo contained in a seed is in reality a young plant, and since an increased size is one of the characteristics of a hybrid plant, it is not unreasonable that this increased size should be apparent in the early as well as in the later stages of the plant's development.

That the hybrid seed is larger than that of the parent varieties and that the increase may be of practical importance is also indicated by the results of experiments recently reported by Mr. Lyman H. Carrier, of the Virginia Agricultural Experiment Station. Mr. Carrier finds that rows planted with pure strains of standard varieties produced at the rate of 5 to 18 bushels more per acre when the strains were allowed to cross-pollinate than when cross-pollination was prevented. The experiments included different varieties and were repeated with essentially the same results.

CHOICE OF VARIETIES.

In the experiments conducted by the United States Department of Agriculture the most significant increases have followed the crossing of carefully selected strains or strains that have been isolated for relatively long periods. It is not to be expected that a cross between two mixed and unselected varieties will show any marked increase over cross-bred seed of the parent varieties. Owing to the heterogeneous composition of such unselected fields, a cross between two plants in the same field may be as truly a first-generation hybrid as a cross between plants of two different varieties.

The large increases secured in the early experiments were probably due in part to the fact that the yields of the parent strains were somewhat depressed from self-fertilization. Under ordinary field conditions a varying proportion of the seed produced is self-fertilized, a fact known to reduce the yields. In none of the early experiments were the hybrids compared with pure-bred seed of the parent varieties derived strictly from the cross-fertilization of individual plants, and larger yields could doubtless have been secured with parent varieties by taking the precaution to have all seed cross-pollinated. To secure cross-pollinated seed of a pure strain, however, requires the same precaution and the same labor that is necessary to secure hybrid seed between two varieties, and the chance of obtaining the maximum yield is much less.

Unless planted at different times it is necessary to choose parent varieties that will flower at approximately the same time. If there is a slight difference the late variety should be chosen for the male parent, since the pollen is usually produced a few days in advance of the appearance of the silks.

A further precaution is necessary where seed of a uniform color is desired. To insure this it will be necessary to select parent varieties of the same color. If a white and a yellow variety are crossed the crop grown from the hybrid seed will be mixed white and yellow.

While further study may be expected to show the particular types and varieties of corn that can be depended upon to give the maximum yields in different localities, it is still the safest procedure to select as parents two local but unrelated varieties of known worth, preferably varieties which have been carefully selected.

FIRST-GENERATION HYBRIDS IN SWEET CORN.

With sweet corn the problem of utilizing the vigor of first-generation hybrids is complicated by questions of appearance, flavor, and uniformity which are of minor importance in the production of field corn. Few experiments with hybrid sweet-corn varieties have been conducted; but these indicate that in spite of the more difficult nature of the problem the value of this method will be even greater in sweet corn than in field corn. The prevalent idea that hybrids are variable and will be lacking in uniformity does not apply to the first generation, which is usually as uniform as the parent varieties. This uniformity may not meet the requirements of score-card ratings, but will be sufficient for all commercial purposes. With regard to the quality that may be expected in the hybrids there is little direct evidence, but in view of the fact that first-generation hybrids are generally intermediate between the parents there need be little doubt that the quality will be satisfactory if parents of good flavor and appearance are chosen.

While yield has not the importance with sweet corn that it has with field varieties, it is still a leading factor. Six varieties of sweet corn were planted at Victoria, Tex., in March, 1910, and 10 different hybrid combinations were made among these varieties. As soon as mature, the hybrid seed was forwarded to Washington, D. C., and planted in comparison with the parent varieties on June 30 of the same year. It was thus possible to make the hybrids and compare their yields in the same season. The season was, of course, too far advanced when the second planting was made for the varieties to show to advantage, but as all required nearly the same length of season their comparative behavior should not be misleading.

The varieties were planted in rows 125 feet in length and the series duplicated as far as seed would permit. In 8 of the 10 hybrids the yield per plant exceeded the average of the parents, and in 6 instances it exceeded that of either parent. The average yield of all the hybrids compared with the average of the pure strain showed

an increase of 57 per cent. The detailed behavior of the 10 hybrids is shown in the following table:

Yield per plant of ten sweet-corn hybrids compared with that of their parents.

Hybrids.	Yield of female parent.	Yield of male parent.	Average yield of parents.	Yield of hybrid.	Percentage of increase of hybrid over average of parents.
	Ounces.	*Ounces.*	*Ounces.*	*Ounces.*	*Per cent.*
Early Minnesota by Sugar	1.05	1.25	1.15	1.50	30
Sugar by Early Minnesota	1.25	1.05	1.15	2.02	75
Sugar by Malakhoff	1.25	1.20	1.22	1.54	26
Sugar by Crosby	1.25	.87	1.06	1.04	− 1.9
Crosby by Malakhoff	.87	1.20	1.03	.76	− 0.26
Early Minnesota by Malakhoff	1.05	1.20	1.12	1.20	0.9
Mammoth by Malakhoff	.29	1.20	.79	.99	25
Mammoth by Sugar	.29	1.25	.77	3.10	310
Mammoth by Oakview	.29	.04	.16	.45	181
Sugar by Oakview	1.25	.04	.64	1.70	165

There are other advantages to be gained by the use of hybrid seed which apply to sweet corn with even greater force than to field corn.

The production of a new and really superior strain of a cultivated plant requires an immense amount of labor and painstaking care. A serious handicap to the development of such improved varieties has been the fact that no adequate remuneration could be expected and that the work must be of a somewhat philanthropic nature. No protection is afforded the originator of a superior variety, and after the initial sale of seed all have an equal chance to profit by his discovery. If, on the other hand, the breeder in addition to developing a new variety can further increase its efficiency by using it in hybrid combination, he can retain control of the novelty so long as he keeps the public in ignorance of the parent varieties used or retains all the seed of one or both of the parents.

CONCLUSIONS.

If two varieties or strains of corn are crossed the plants resulting from the crossed seed are termed first-generation hybrids. Experiments have shown that first-generation hybrid plants are almost invariably more productive than the parent strains. The progeny of these hybrid plants do not show the same vigor and uniformity as those of the first generation, and in order to take advantage of the increased yields it is necessary to make the cross anew each year.

The peculiar habits of the corn plant make it readily possible to produce hybrid seed in large quantities and at a cost that is insignificant in comparison with the increased yields that are obtained.

The utilization of first-generation hybrids should not be confused with indiscriminate crossing or with the developing of hybrid varieties. The strains must be kept pure, to be crossed anew each year.

The evidence that warrants confidence in the increased yields of hybrids rests on the uniformly favorable results obtained in ten independent experiments that have been reported at various times since 1878. The series includes experiments in six different States and embraces a wide range of varieties.

The yields of sweet corn also may be increased by utilizing the vigor of first-generation hybrids. The application of this method to sweet corn also enables the originator of new varieties or favorable combinations to protect his discovery.

THE UTILIZATION OF CROP PLANTS IN PAPER MAKING.

By Charles J. Brand,

Physiologist in Charge of Paper-Plant Investigations, Agricultural Technology, Bureau of Plant Industry.

REVIEW OF RECENT EXPERIMENTS.[1]

During the past ten years many crop materials have been subjected to pulping experiments by some of the more progressive paper manufacturers and by private individuals. In most cases a satisfactory quality of paper has been made, but in the end nothing practical has come of the work. The whole situation might be summarized by the statement that it has been found possible to make paper out of many crop wastes, but it has been found impossible to make money out of more than one or two.

Congress, in making appropriations for the Department of Agriculture for 1908–9, provided the sum of $10,000 to be used in testing "such plants as may require tests to ascertain if they be suitable for paper making." One half of this fund was assigned to the Forest Service for studies of unused woods, the other half to the Bureau of Plant Industry for the investigation of crop and wild plants. Work was taken up in the summer of 1908 on the following: Cornstalks, flax and rice straw, cotton stalks, bagasse, and tules. Since that time broom-corn and hemp stalks, hemp wastes, cotton-hull fiber, stalks of saccharine and nonsaccharine sorghums, *Epicampes macroura* (a southwestern grass whose tops are a by-product of the root-brush industry), Arundo, Arundinaria, Eulalia, and several other plants have been added to the list. During the past year special attention has been given to practical tests in a large book-paper mill.

[1] The writer is indebted to Messrs. F. P. Veitch and J. L. Merrill, of the Bureau of Chemistry, for all chemical determinations; to Dr. H. S. Bristol and Mr. Edwin Sutermeister, of the Forest Service, for assistance in much of the earlier work, and to the Bureau of Standards, Department of Commerce and Labor, for testing the papers produced in the many commercial and semicommercial runs at the paper mill. The Bureau of Animal Industry, through Dr. E. C. Schroeder and his assistant, Mr. W. E. Cotton, aided the work by conducting a preliminary feeding test of the extract obtained from cornstalks.

CORNSTALKS.

Cornstalks were taken up first for several reasons: (1) They represent an enormous supply of raw material—the greatest unused crop by-product. Over 100,000,000 acres are now devoted annually to Indian corn in the United States. Taking 1 ton as the yield of stalks per acre, which is a very conservative estimate, there are produced at least 100,000,000 tons of stalks each year. Certainly not more than one-third of this vast quantity is put to paying uses in present farm practice. Ignoring another third, which may be produced in scattered localities, thus adding a factor to the considerable expense that would be involved in assembling it, there remain fully 30,000,000 tons of cornstalks grown in the area known as the "corn belt." A great addition to farm wealth would result if some of this supply of material could be made into paper and pulp products at a reasonable profit. (2) Results obtained with cornstalks would be applicable in a considerable measure to all grasses, rushes, and sedges which have a similar structure, and in less measure to dissimilar plants having some of the same cellular elements. (3) Considerable pioneering work had been done with cornstalks, the results of which were accessible to the Department.

While the cornstalk experiments have been encouraging, they have not yet produced results that justify a definite pronouncement. Paper of excellent quality has been made from eight or ten varieties of corn during the past season, but it remains to be determined whether the profit to the manufacturer will enable him to give the farmer enough for his stalks to pay for harvesting, shredding, baling, and delivering the same. All parts of the corn plant except the ears and roots are used. Under present plans it is expected that cornstalks will yield three products:

(1) Long fiber, which, on account of its strength and its good felting and other desirable qualities, is suitable for book, writing, and other papers of the better class. Bone-dry stalks will yield from 12 to 18 per cent of long fiber, varying with the variety, conditions of growth, and chemical treatment.

(2) Pith pulp, suitable for pulp and paper specialties, such as insulating material, grease-proof wrappers, pie plates, fiber boxes, and possibly bottles. The yield of pith will range from 15 to 30 per cent of moisture-free stalks. The usefulness of pith pulp for standard products is not as great as that of the long fiber, but it is a plastic material that should serve many useful purposes. The character of the fiber and pith cells is shown in figure 16.

(3) Cornstalk extract, the soluble solids of the stalks, obtained by water extraction or by saturation under pressure and subsequent expression. The method most commonly employed in obtaining this extract is to place the shredded stalks in the digester with a quantity

of water and boil for an hour under a steam pressure of from 50 to 70 pounds. The liquid containing the soluble solids is then drained off and evaporated to the desired consistency, while the extracted stalks remain in the digester ready for cooking with caustic soda.

A ton of cornstalks will yield from 200 to 300 pounds of soluble solids containing the greater part of the food value of the stalks. When made under the best conditions from 8 to 12 per cent of the extract is protein, about 25 per cent is invert and cane sugar, and about 25 per cent more is sugars of the pentose and pentosan class.

About 25 gallons of extract of molasses-like consistency were produced at a paper mill during the summer of 1910, and a month's preliminary feeding test of two animals was made in cooperation with the Bureau of Animal Industry of the Department of Agriculture. All of the food mixed with dry matter was eaten and no injurious effects were observed. It remains to make a conclusive test with a larger number and a greater variety of animals before the nutritive value of the material can be determined or whether it is injurious if fed for a long time. As broom-corn and sorghum stalks and rice straw yield a similar extract, the possibility of reclaiming the food elements will very likely be one of the factors in determining whether or not the wastes of crop plants can be put to practical use in paper making. If cornstalk extract proves valuable and the water-soluble solids can be returned to the farm, mixed with roughage, and fed, an important step in conservation will have been gained, as the removal of the raw material from the farm need not then represent a serious attack upon the soil resources. The extraction of the soluble solids from the stalks is beneficial, because it leaves them in an improved and advanced condition for chemical treatment and lessens the cost by reducing the quantity of chemicals required.

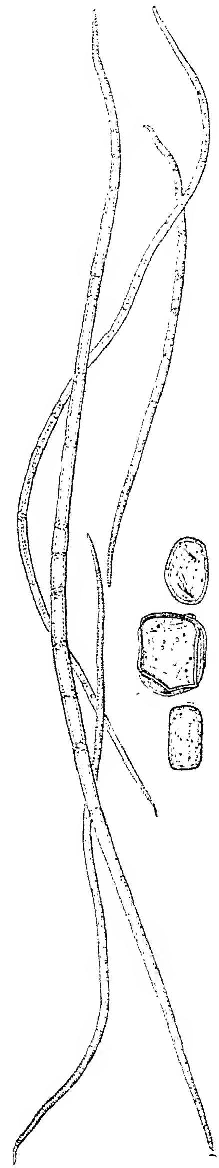
FIG. 16.—Long fiber and pith cells of Indian corn. (Enlarged 71 times.)

Cost estimates are incomplete, but it appears that the farmer could not afford to handle the raw material for less than $5 a ton, air-dry. If the extract has any value it is probable that the manufacturer could afford to pay

this, though these are matters upon which more accurate data must be secured and which must necessarily be finally decided in actual practice

BROOM CORN.

Both the corn and broom-corn stalks used in the Department's experiments were grown at specially selected places, and a careful record has been kept of the yield, the cost of production, the space required for storage, and the keeping quality of the materials. On the whole, the collaborators who grew broom corn had better success in the production of stalks than those who grew corn. As a consequence, broom-corn stalks have been investigated more thoroughly than other materials. As a large number of digestions or "cooks" of Indian corn were made first, much experience was gained which was of decided advantage in the tests of broom corn.

Broom corn throughout its cultural history has been selected for the production of a greater quantity and better quality of fiber in its "brush." It would be only natural if the production of fiber in one portion of the plant should be correlated to the higher fiber value of the plant as a whole. This appears actually to be the case. At any rate, broom-corn stalks contain a higher percentage of long fiber than do cornstalks. As a result of the experiments that have been made with broom-corn stalks it may be conservatively stated that this crop by-product is suitable, so far as the quality and yield of its pulp are concerned, for immediate use in paper making. Like cornstalks, it reduces readily to pulp with a comparatively low consumption of chemicals and steam. The time required for pulping is from 3 to 4 hours, as compared with 8 to 12 hours for wood. In addition, preliminary tests indicate that there will be no great difficulty in recovering the caustic soda used in digestion.

In tests on a laboratory and semicommercial basis, yields of 32 to 40 per cent of fiber were obtained. Later, a cook of 3½ tons was made in the largest sized rotary digester in common use for wood, on which a yield of practically 42 per cent was obtained.[1] It appears from this that it will be safe to expect this percentage of fiber in actual practice. It was found that the proportion of pith in broom-corn pulp is so low that it could be made directly into a fair quality of white paper, which, however, would probably be too brittle for most purposes. Experiments were also made to test the effect of combining broom-corn pulp with certain proportions of soda pulp from poplar and sulphite pulp from spruce. It was found that a combination of 50 per cent of broom-corn pulp, pith, and long fiber unseparated, together with 50 per cent of poplar, produced

[1] Acknowledgment is here made for much assistance and information furnished by S. D. Warren & Co., Cumberland Mills, Maine.

what was pronounced by practical paper men as a merchantable quality of book paper. In combination with sulphite fiber from spruce a stronger though somewhat harsher sheet resulted.

The results that have been secured with broom-corn stalks indicate that this material is suitable for immediate use in paper making, both on the basis of quality of fiber produced and on yield of fiber secured. Broom-corn stalks have one serious disadvantage, namely, the limited production of raw material. The figures for the recent census are not yet available, but according to the returns of the Twelfth Census 178,584 acres were devoted to broom corn in 1899. The yield of stalks to the acre will probably approximate very nearly 3 tons; hence, the quantity produced will probably be in the neighborhood of 450,000 tons. Many States grow small acreages of broom corn, but Illinois, Kansas, Oklahoma, and Missouri probably produce fully two-thirds of the total crop. It is possible that in these States there may be localities where the acreage cultivated near one central point is so large that pulp could be produced economically.

The harvesting of the stalks for pulp making does not interfere with the harvesting of the brush for brooms, nor would it in any way reduce the quality of the brush produced.

Broom-corn stalks, like cornstalks, yield a product under water extraction containing practically the whole food value of the raw material. In the case of broom corn it seems likely that the stalks could be pulped at a profit without taking into account the possible value of the food extract.

RICE STRAW.

Rice straw may be regarded as one of the most promising crop materials available for paper making at the present time. In China and Japan this material has been employed for many years. There has been considerable discussion about its use in the United States, but up to the present time no commercial plant has been constructed for the purpose. Private experimenters have produced excellent qualities of book and writing papers from it, more particularly in combination with sulphite pulp and cotton-hull fiber. In the experiments of the Department, yields of from approximately 32 to 40 per cent have been secured. Not less than 35 or 36 per cent could be expected in practice. The character of the long fiber of this straw is shown in figure 17. Pith cells are also present in rice straw, but not in such proportion as in cornstalks. Indeed, it has been found perfectly feasible to produce paper without attempting to remove the pith cells, but merely combining the straw pulp with a suitable quantity of sulphite, soda, or cotton-hull fiber.

Rice straw also yields a food extract which in the analyses thus far made runs rather high in protein; nevertheless, it does not seem necessary in the case of this waste to depend upon the extract in order to make the material as a whole utilizable.

Rice straw has a distinct advantage over cornstalks in that it is assembled at one place for thrashing and can be baled at once without extra cost for hauling in from the field and shredding. Although it does not promise to give as high a yield of fiber as broom-corn stalks, it has a distinct advantage over these because of the greater acreage grown. It has a further advantage over both corn and broom corn in that it is grown rather compactly in restricted areas, so that a pulp or paper mill located in any good rice-growing section could secure its supply of raw material within a comparatively small distance from the mill. Texas, Louisiana, Arkansas, and South Carolina are the great rice-producing States. At present these have a total of only four paper mills.

FIG. 17.—Rice-straw fibers. Though comparatively short, these are strong and felt well. (Enlarged 71 times.)

The number of acres of rice harvested in the United States in 1909 was 720,000. Growers state that the yield of straw will run from 2 to 2½ tons an acre. Using the lower yield, in the neighborhood of 1,500,000 tons of rice straw are produced annually. At the present time this is largely a waste product, though a small part is fed to stock. It is also baled to some extent and shipped to the larger cities for stable bedding, bringing about $4 to $4.50 a ton. If the price of wood continues to advance, rice straw should be one of the first crop materials put to practical use.

COTTON-HULL FIBER.

Cotton-hull fiber is the lint that remains adhering to the hulls after the long fiber has been removed by the gin and the shorter fiber by the reginning machines. The hulls are a by-product of the cottonseed-oil industry.

The fiber is used to some extent as a source of cellulose in the manufacture of guncotton; also as a stuffing material for pads and horse collars, and in upholstering. It may be removed from the seed before crushing or from the broken hulls after the seed has been crushed and the kernels extracted. The fiber obtained before crushing has not been tested in the writer's experiments. That obtained from the broken hulls contains a high percentage of the hull material, which is re-

moved with some difficulty. As the particles of the hull do not digest or bleach as readily as the fiber, they frequently show up in the pulp or finished paper as small brown specks, which would seriously interfere with the salability of the product.

There is some diversity of opinion among producers as to the quantity of cotton-hull fiber that could be made available. It would probably be rather small. It is not suitable for paper making in a pure state, as it is somewhat deficient in strength, and furthermore it will probably command a higher price for other purposes than paper manufacturers can afford to pay. Cooked in the same digester with corn, broom corn, or rice straw, cotton-hull fiber has been found to facilitate greatly the draining of the pulp and also to add softness to the paper. It is possible that its beneficial effect in this respect might make a market for a limited quantity of this material in connection with the others mentioned. A further possibility is that this fiber, treated by special processes, may prove suitable for particular grades of paper that command unusually high prices. At present, cotton hulls with the short lint adhering are sold for fertilizer and command $5 to $8 per ton at the point of production. The hulls are also mixed with the ground oil cake after expression of the oil and made into stock feeds of various grades. When used as a component of stock feed it is desirable to remove the short lint. Cotton-hull fiber will probably never be used extensively in paper making, and it is only mentioned here because it may prove a valuable adjunct in the working up of other crop by-products.

COTTON STALKS.

Cotton stalks tested in cooperation with the Forest Service of this Department were among the first crop wastes reduced to pulp. The aggregate quantity of these stalks produced in the United States is large. Those who have given attention to the matter estimate it at 10,000,000 tons. The yield per acre of stalks is much lower than that of any of the raw plant materials thus far discussed, and probably does not exceed 1,000 pounds per acre. Cornstalks will average more than twice this quantity; rice straw, four times as much; and broom corn, six times this total. Numerous inventors have been attracted to cotton stalks by the large quantity grown, and much has been claimed for paper said to be made from them. At the present time no paper mill is using the material.

In the experiments thus far conducted by this Department cotton stalks have been found to require harsh chemical treatment, using about 30 per cent of caustic soda, which is 5 per cent more than poplar wood requires. They required from six to nine hours, with steam pressures of from 90 to 110 pounds, for cooking. The yield of fiber

ranged from 35 to 43 per cent in various tests, but the fiber was found to be short and inferior in strength. With this yield and the low production of 1,000 pounds per acre it would require 5 acres of stalks to make a single ton of pulp. Difficulties were also encountered in connection with bleaching. The dark outer bark proved very refractory, necessitating the use of a large quantity of bleaching powder. All samples of paper made from this material which the writer has examined contain so much unbleached material as to render them unsuitable for anything except wrapping purposes. It is possible that methods may be devised which will produce a pulp sufficiently white and a fiber sufficiently strong to make cotton stalks a promising material, but the results obtained to date are not encouraging.

BAGASSE.

Bagasse is the refuse of the sugar cane after the juice has been expressed. It is susceptible to the treatment given to the stalks of corn and broom corn and some of the other materials that have been discussed. When treated by the caustic-soda process in the ordinary manner the yield of pulp has been comparatively low. The individual fibers, while rather short, are slender, so that a moderately strong sheet of paper can be produced. The pulp bleaches easily, especially if it has first been extracted by the method described for cornstalks. A large percentage of pith is present, which, in practice, would have to be dealt with as in the case of corn. Several small plants have been built with a view to making various forms of pulp board and the rougher grades of paper from bagasse, but so far as the writer knows none of these has been permanently successful. The fact that the material is all assembled at the sugar mill and thoroughly broken up in the process of crushing should favor the utilization of this waste. On the other hand, the fuel value of bagasse must be carefully considered in any plan to utilize the material. The sugar industry, as now organized, counts on the refuse to furnish a very large proportion of the fuel required for the boilers. Its value for this purpose has been variously estimated at from $1.50 to $3 per ton. Both figures are probably too high.

FLAX STRAW.

In the United States flax is grown almost exclusively for seed, the annual production amounting to something more than 25,000,000 bushels. The number of acres harvested is about 2,500,000. On an average, between 2,000 and 2,500 pounds of straw are produced to the acre. At the present time not more than 250,000 or 300,000 tons of the total product of approximately 3,000,000 tons are used.

Recent years have seen considerable development in the use of flax straw, but much remains to be desired, considering the generally promising nature of the material. Many extravagant claims have been made and much promoting has been done, some of it of an extremely questionable character, on the basis of the supposed value of the straw of seed flax for textile and other purposes. At the present time its profitable use is confined almost wholly to the manufacture of binding twine, upholstery tow, and insulating material for refrigerator cars and cold-storage houses. The waste straw of the flaxseed industry is a totally different product from the carefully handled and prepared fiber from which linen fabrics are made. Even for twine-making purposes the straw must be harvested and thrashed in a particular way in order to produce a satisfactorily smooth quality of twine.

When cooked by the caustic-soda process the straw produces a material decidedly strong and in many respects promising. The yield of pulp to raw material has not run much over 30 per cent. Much private capital has been spent in attempts to make paper from flax straw, but as yet there is no mill in the United States that uses the material. Recently private agencies have conducted extensive experiments with a view to producing paper suitable for cement bags and the like. The requirement is an extremely difficult one, as paper for such purposes must have extraordinary strength. Some of the papers produced came up to the requirement, and the results as a whole were encouraging. In these tests tow was used and not the flax straw as it comes from the thrashing machine. If this method were followed in practice there would be a considerable addition to the expense for raw material. It requires from 3 to 4 tons of straw to make 1 ton of tow, and medium tow is worth over $20 per ton at the tow mills. Flax straw must be regarded as one of the most promising materials, but extreme caution should be used in its exploitation. Straw from different sources differs in strength and quantity of fiber; climatic conditions appear to have a profound effect upon its fiber value.

MISCELLANEOUS CROP MATERIALS.

In addition to the crop by-products that have been discussed there are other materials that may prove of value. Among these are the common grain straws, the wastes of hemp, jute, flax, manila, and other fiber crops, and the stalks of the grain sorghums which are now being cultivated on considerable areas and whose culture is being extended rapidly. *Epicampes macroura*, a southwestern grass, which is especially plentiful in Mexico, may prove useful, as it has an excellent fiber. This plant, which is known as "zacaton," furnishes the so-called "rice roots" so extensively used in the making of brushes.

In the brush industry only the roots are used, and the tall-growing stems and leaves with their fine fiber are a waste product.

Two points should be borne in mind in all attempts to make pulp from crop wastes: That not all materials are suitable for making expensive products and that it not infrequently happens that there is as much profit, because of lessened cost of production and greater demand, in making cheaper products for which the material may be better adapted, as in making the higher priced articles.

PLANTS THAT MAY BE GROWN AS PAPER CROPS.

In addition to the waste materials that are available, evidence has been gathered that certain crops can probably be grown at a profit to both the grower and manufacturer, solely for paper-making purposes. One of the most promising of these is hemp. Hemp grows well in most parts of the country and produces very high yields of raw material. The average production of "hay-dry" hemp stalks per acre will reach very nearly 5 tons. Of retted stalks, an average of from 2½ to 3 tons can be expected. When dew-retted, as is the common practice, the tax on the soil of growing the crop is very light—an exceedingly important point in farm economics. According to careful estimates by Prof. L. H. Dewey, hemp can be grown through the retting stage at a cost of about $14 an acre. With an average yield of 2½ to 3 tons of retted stalks, it seems very likely that hemp can be grown profitably solely for paper stock.

Hemp produces a paper of great durability and great strength in thin sheets. The retted stalks will yield from 40 to 45 per cent of cellulose. The fiber (fig. 18) is of such a nature and length as to fit it for the manufacture of numerous special papers that will command better prices than the ordinary grades. Should retted hemp come into use as a paper-making material it will effect a considerable saving in certain years to the hemp-fiber industry, as it frequently happens that hundreds of tons of hemp stalks are over-retted, making them unfit for textile use. These could be worked into paper to advantage.

Another plant from which excellent paper has been produced is the well-known Japanese grass *Eulalia japonica*, which is much used in this country for ornamental purposes. This plant thrives luxuriantly in the latitude of Washington on some of the poorest soils. It yields a fiber similar to that of esparto in its behavior. A large paper-manufacturing company has grown this grass as far north as Maine and has produced some excellent varieties of paper from it. Preliminary observations on a plat of the grass growing near Washington, D. C., on very poor soil, indicate that an average yield of at least 2 tons to the acre may be secured.

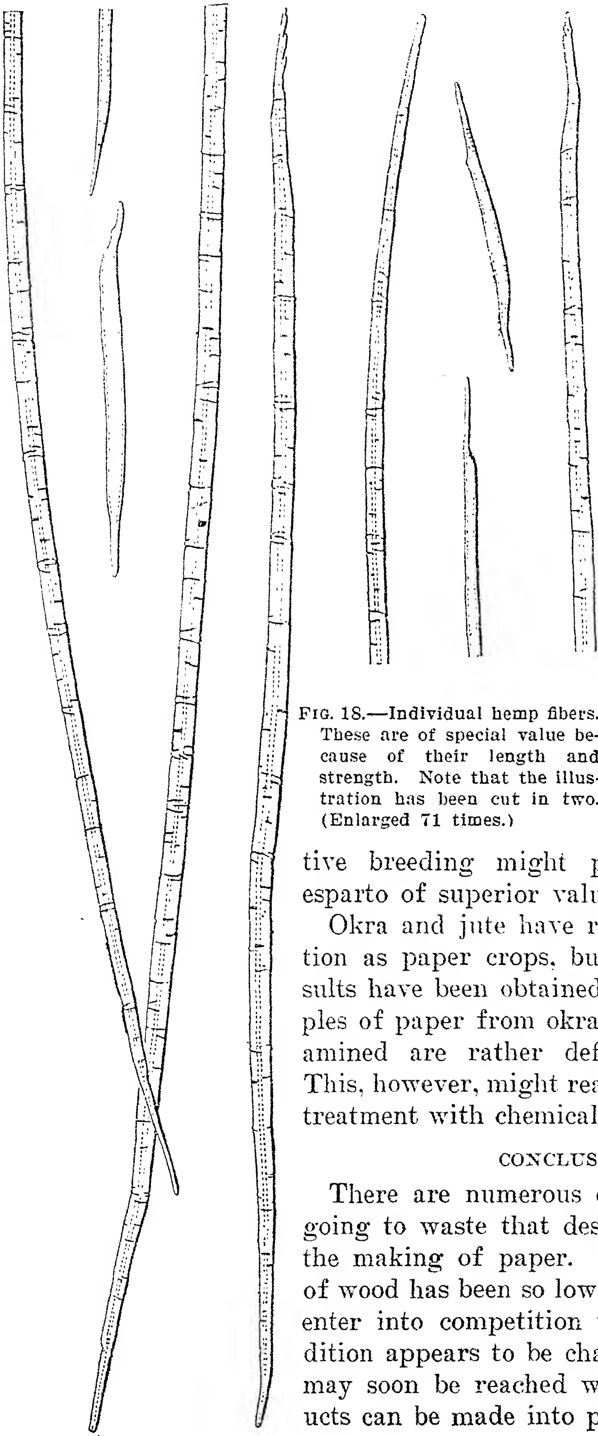

FIG. 18.—Individual hemp fibers. These are of special value because of their length and strength. Note that the illustration has been cut in two. (Enlarged 71 times.)

Esparto, which is one of the most highly prized sources of paper in the Old World, may be useful in some parts of the Southwest where there are extensive areas of unused dry land. This grass is one of the important sources of paper in Europe. The present supply is obtained from the dry regions of Algeria, Tunis, Tripoli, and Spain, where it grows wild and is harvested by hand. It seems likely, furthermore, that the application of methods of selective breeding might produce strains of esparto of superior value.

Okra and jute have received some attention as paper crops, but no conclusive results have been obtained with them. Samples of paper from okra that have been examined are rather deficient in strength. This, however, might readily be due to overtreatment with chemicals.

CONCLUSION.

There are numerous crop materials now going to waste that deserve utilization for the making of paper. Hitherto, the price of wood has been so low that they could not enter into competition with it. This condition appears to be changing, and a point may soon be reached where crop by-products can be made into pulp and paper at a

profit to both the farmer and the manufacturer. There does not seem to be any reasonable hope at the present time of producing paper stock from crop wastes that will be cheap enough to use for printing newspapers. This is due chiefly to two causes—the low cost at which such paper can be produced from ground wood and the striking adaptability of ground wood pulp to the newspaper printing industry.

Not only is the grinding process the cheapest method of obtaining print paper of any character, but it also produces the highest proportion of pulp to raw material. While the two chemical processes which have been discussed produce on an average only about 1,000 pounds of pulp per cord of wood, the yield of ground wood pulp per cord is considerably over 2,000 pounds. Although lacking in durability, ground wood fiber, with the addition of a small proportion of stronger and better chemical fibers, answers its intended purpose admirably. It is light, reducing freight cost on the unprinted paper and postage on the printed. It is opaque, printing readily on both sides of moderately thin sheets, and, finally, it has excellent ink-absorbing qualities, fitting it unusually well for use on the high-speed presses of the present day.

Wood will probably be used for making news paper long after other materials have acquired importance in many branches of the chemical pulp industry. It should be added that chemical pulp papers, such as books and magazines are printed upon, consume over 1,000,000 cords more wood each year than that consumed by the ground-wood industry.

There is some skepticism as to the failure of the pulp-wood supplies, but this is certainly poorly grounded. During 1909 the quantity of spruce used was less by 40,000 cords than in 1907, but the cost was $2,000,000 greater. Present efforts in connection with the reforestation of spruce and poplar are not extensive enough to produce any noteworthy effect upon the available supply within a generation. At the present rate of increase in consumption, it will require between 15,000,000 and 20,000,000 cords of wood to satisfy the demand for pulp and paper fiber in 1950. It will certainly be impossible to furnish this from the forests. If every acre cut over each year were reforested it would be twenty-five or thirty years, or possibly even longer, before the trees could attain sufficient size to warrant cutting. The forests can not recover from the overdrafts continually being made upon them; hence it is only a question of a limited number of years until paper fiber must be grown as a crop, as are practically all other plant materials entering into the economy of man. While the conservation of only a few of the by-products of the farms yielding paper fiber can be accomplished profitably in the near future and only a few plants promise to be money-makers immediately if grown solely for paper production, it seems very probable that raw products now scarcely considered may in a few years play an important part in the paper and pulp industry.

INJURIES TO FORESTS AND FOREST PRODUCTS BY ROUNDHEADED BORERS.

By J. L. Webb.

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FOREST INSECT DEPREDATIONS.

In recent years much stress has been laid upon the conservation of natural resources in the United States. Of these resources, the forests have probably absorbed more attention than any other. Vast areas have been set aside from the public domain as National Forests in order that the timber supply of the country shall not become exhausted. Much has been said on the subject of damage by fire to the forests, and it is fully realized that this is an ever-present danger. But a more insidious and equally relentless foe of the forests is found in the form of insects which work terrible destruction, often unnoticed until the damage is done. The immense destruction to living forests by certain scolytid barkbeetles, as well as the injurious work of flat-headed borers, have been given attention in former Yearbook articles. In this article another group containing many injurious species is discussed, namely, roundheaded borers. The information conveyed in this paper is based almost entirely on the material and records of the forest insect collection of the Bureau of Entomology.

ROUNDHEADED BORERS.

Roundheaded borers are so called to distinguish them from the flat-headed borers.[1] The general appearance is that of an elongate, fleshy, yellowish-white grub, sometimes bearing three pairs of legs and sometimes without legs. The head is more or less oval in shape, though sometimes elongate, and often deeply retracted within the first prothoracic segment, which is situated immediately behind the head. The head is provided with a strong pair of jaws or mandibles, brown or black in color, for cutting through plant tissue. Some species mine only in the bark of trees, some mine in both bark and wood, and some confine themselves to herbaceous plants. In each case the borer is hatched from an egg laid upon or in the bark or

[1] See "Injuries to forest trees by flat-headed borers," Yearbook, 1909, p. 399.

wood by the parent beetle. It lives and feeds entirely within the bark or wood until it attains its full growth, when it changes to the pupa, or resting stage, within its burrow. The pupa later transforms to a beetle, which emerges and flies in search of suitable places to repeat the process of propagating the species. In nearly every instance the entire damage is done while the insect is in the grub, or borer, stage. This form is therefore the most important from an economic standpoint.

ECONOMIC IMPORTANCE.

Some species of roundheaded borers kill trees outright by mining in the bark, thus destroying the vitality of the tree, while others injure the wood of dead, dying, or felled trees, or timbers manufactured from such trees. Still others both kill the trees and injure the wood for commercial purposes. The annual loss to owners of forest trees and forest products from this source, if figured up in dollars and cents, would amount to a sum far in excess of what the ordinary individual would think possible.

CHARACTER OF WORK.

The work of this class of insects usually appears as irregular winding mines or "wormholes" in the bark and wood. The mine always starts in the bark, where the minute larva just hatched from the egg starts to bore and feed. At first the mine is very small, but gradually becomes larger as the borer advances and grows in size. As already indicated, the work of some species is confined entirely to the bark. The work of other species is found in both bark and wood. In this case the mine is continuous from bark to wood, the entrance into the wood being a flattened oval hole. That part of the mine which is in the wood may be long or short, according to the species. In general it is more or less winding and irregular, contains borings and woody excrement, and finally broadens out into a cell or "pupal chamber." At the farther end of this cell the mine, or "exit burrow" as it now becomes, usually leads directly to the surface by the shortest route. Upon the surface it usually appears as a perfectly round "exit hole" (fig. 21, *d*).

LIFE HISTORY AND HABITS.

As a usual thing the adult female beetle lays an egg or a cluster of eggs either in or upon the bark in the spring, summer, or early fall. Sometimes the parent female excavates a pit in the bark with her mandibles, through which the eggs are thrust by means of the ovipositor. In other cases eggs may be deposited in crevices of the bark or under the overlapping scales of bark. In a few days after the egg is

deposited a minute wormlike larva (fig. 19, *c*) issues therefrom and immediately begins boring into the bark with which it finds itself in contact. The larva usually proceeds directly to the inner bark, or cambium, immediately next to the wood. Here the larva mines and feeds until it reaches a certain growth, when it makes preparation for a change called pupation. The entire growth of the insect is attained in the larval form. Usually, before it attains full growth, however, the larva mines either into the solid wood or into the outer corky bark and digs out an elongate oval cell, in which it will soon pupate. From the farther end of the pupal cell the larva, as a general thing, extends the mine almost to the surface of the tree or log, in order to facilitate its emergence into the open air when it has gone through its changes in the pupal cell to the adult or beetle form. This work completed, it retires to the pupal cell and awaits the change to the pupal form. Finally the outer skin comes off and the insect has an entirely different form and appearance (fig. 20, *d*). It is now a pupa. The length of time passed in this form is variable with the species and with the local conditions, the pupa resting perfectly quiescent in its cell during this period. At length another change takes place and the insect is in the adult or beetle stage (fig. 20, *b*). At first the beetle retains the white color of the pupa and larva, and the outer tissue of the body is quite soft. But gradually the color turns darker and the outer tissue becomes hard and chitinous. When

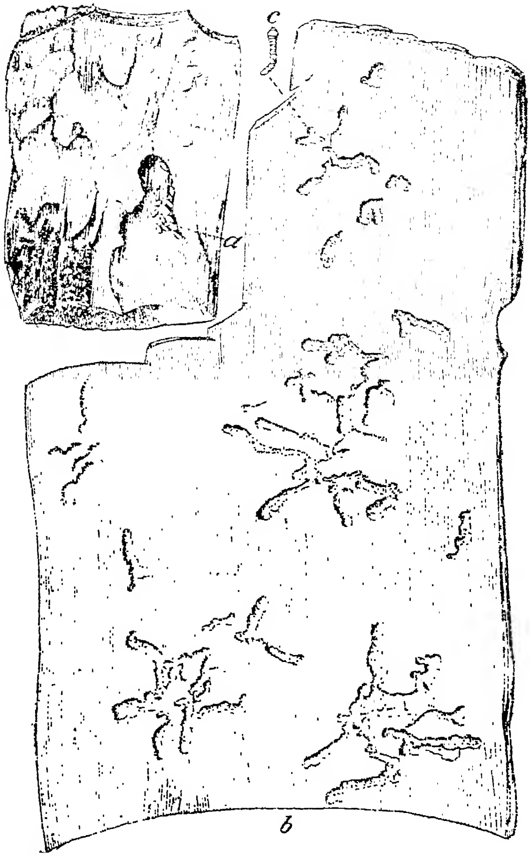


FIG. 19.—Work of the western larch bark-borer (*Tetropium velutinum*). Sections of bark of western larch: *a*, Cluster of eggs deposited under overlapping scale of outer bark, the overlapping scale, in this instance, having been removed; *b*, inner surface of bark with newly started mines; *c*, small larva, a few days old. Slightly enlarged. (Original.)

fully hardened and mature the young beetle crawls into the mine leading away from the pupal cell and completes this mine to the surface of the tree or log. It then flies away. Mating and egg laying soon follow to provide for another generation.

SEASONAL HISTORY.

Probably in the great majority of cases the larva does not change to the pupa until the spring following the season in which the egg is laid, passing the winter either in the larval mine or in the pupal cell. However, pupation may take place in the fall and the winter be passed in this stage, or the adult stage may be reached in the fall and the winter be passed in this form within the pupal cell. The following spring the larvæ which have wintered over transform to pupæ. The pupæ soon transform to adults and the adults emerge and take flight. Likewise, the pupæ which have wintered over transform to adults and emerge. The first to emerge, however, are those individuals which have wintered over as adults. Sometimes a species may have two generations a year, or a partial second generation. In these cases development takes place rapidly after the eggs are laid in the spring, the adult insects of the first generation emerging in late summer or fall, and laying eggs for the second generation. The second generation passes the winter as outlined above. In still other and more rare cases two or more years may be necessary for the complete development of certain species.

THE WESTERN LARCH BARK-BORER.

(*Tetropium velutinum* Lec.)

At the present time the western larch bark-borer is quite a serious pest in the Glacier National Park in Montana. In the vicinity of Lake McDonald about 10 per cent of the stand of western larch or tamarack is being killed annually by this bark-borer. Besides larch it attacks fir, Douglas fir, western hemlock, and pine, in the Rocky Mountain and Pacific coast regions.

The eggs are deposited in clusters under overlapping scales of bark (fig. 19, *a*) and the minute larvæ hatching therefrom proceed to the inner bark, where they immediately commence their mines (fig. 19, *b*).

The work of this borer in larch is confined to the bark, though in some of the other host trees mentioned above it sometimes enters the sapwood. The larval mine is irregular and winding in the inner bark. The number of mines is so great as to completely girdle the tree and cut off the sap, thereby causing the death of the tree. Often almost the entire inner layer of bark, or cambium, is destroyed for quite a considerable space upon the trunk (fig. 20, *a*).

The grub (fig. 20, *c*) is elongate and somewhat cylindrical, yellowish white in color, and about 1 inch long when full grown. Its mouth-parts are dark brown to black, and the under side of the body is provided with three pairs of minute legs. It lives in the bark about a year, emerging in the spring or summer as an elongate, brownish to black beetle (fig. 20, *b*), the surface of the body having a velvety appearance. The beetle ranges in length from 9 to 19 mm.[1] The principal time of emergence is May and June. This species attacks either healthy, injured, or felled trees.

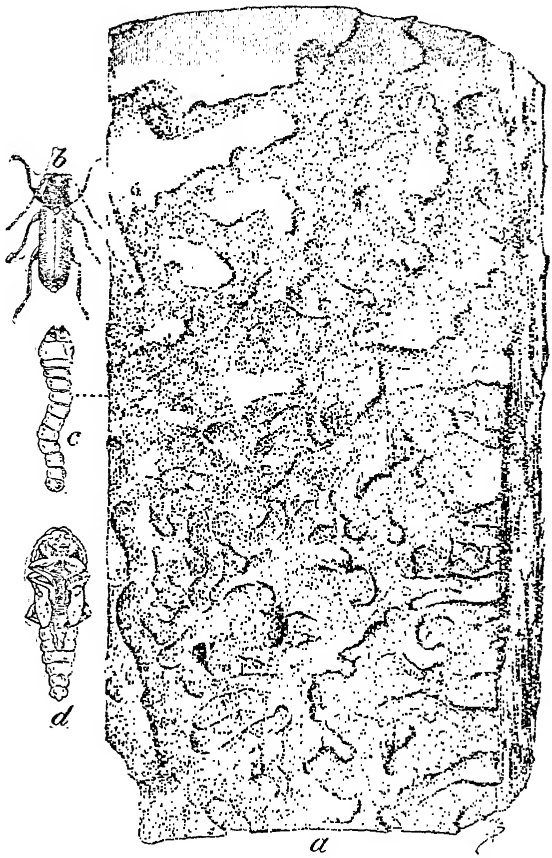


FIG. 20.—Work of the western larch bark-borer (*Tetropium velutinum*). Section of bark of western larch: *a*, Completed larval mines in inner bark; *b*, adult beetle; *c*, larva; *d*, pupa. Insects approximately natural size. (Original.)

The methods of control are preventive. Once a tree is badly infested nothing can be done to save that particular tree. Something can be done, however, to stop the spread of the infestation to other trees. Infested trees should be felled and barked and the bark burned before May 15. Something could also be accomplished by the use of trap trees. As the insect breeds readily in felled trees, a few healthy trees felled in May or June near those infested would attract the beetles which would otherwise deposit their eggs in healthy trees. Later in the season, or before the following spring, the bark should be stripped off the trap trees and burned.

[1] 1 mm.=$\frac{1}{25}$ inch.

THE SOUTHERN PINE SAWYER.

(*Monohammus titillator* Fab.)

Within recent years the States of the extreme south have suffered severely from cyclones and other windstorms. An immense amount of pine timber has been felled by these storms. In practically every case great damage has been done to the fallen timber by the southern pine sawyer over the entire area covered by the storm. It has been estimated that during the years 1906, 1907, and 1908 the pecuniary loss from this source in the Southern States was over $6,000,000.[1]

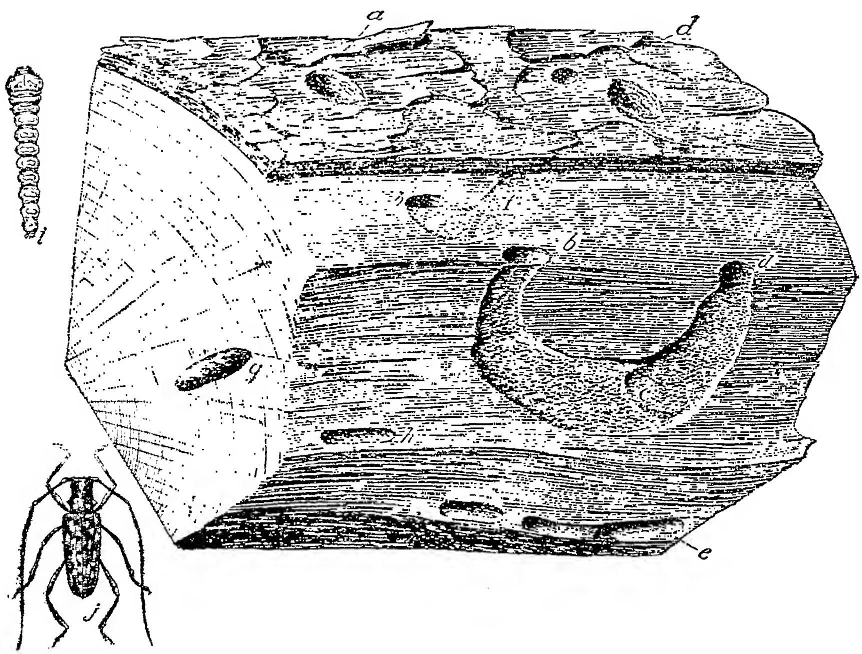


FIG. 21.—Work of the southern pine sawyer (*Monohammus titillator*). Section of trunk of storm-felled longleaf pine, showing: *a*, Egg pit in bark; *b*, entrance hole of larva into wood; *c*, pupal cell; *d*, emergence hole; *e*, *g*, *h*, sections of larval mines; *f*, scored surface of wood, scoring done by larva preparatory to entering wood; *i*, larva; *j*, adult. Insect one-half natural size. (Original.)

This insect never attacks healthy trees, but only those already dead, dying, or felled. The damage to each tree or log is the work of the larvæ or grubs which, after first mining in the bark, mine in and through the sapwood, and even penetrate the heartwood, making large unsightly holes (see fig. 21) which cause the lumber made from this portion of the log to be thrown into the lowest grade, known to the lumberman as "No. 2 common." The larva is an elongate, footless, white grub (see fig. 21, *i*). The size varies considerably in different

[1] U. S. Dept. of Agriculture, Bureau of Entomology, Bul. 58, Part IV, p. 45.

individuals and according to age. The largest at maturity have been found to measure slightly over 60 mm. in length and 9 mm. in breadth at the broadest point. It appears that normally there is one generation of this species per year, with a partial second generation. Thus, a few larvæ hatched from eggs deposited in the spring go through their changes to the adult form and the adults emerge in the fall, while the larger number of the larvæ hatched from eggs deposited in the spring and summer hold over until the following spring, when the adults emerge. The adult (fig. 21, *j*) is an elongate beetle varying from 16 to 31.5 mm. in length and from 5 to 10 mm. in width. The color is a mottled gray and brown. In the male the antennæ ("horns") are very long, often being two or three times the length of the beetle. In the female they are much shorter. The principal time of emergence in the Southern States seems to be March and April.

Injury to felled pine timber by this species may be prevented in two ways. First, by placing infested logs in water while the larvæ are still in the bark and before they have entered the wood; and second, by removing the bark from the logs before the larvæ have entered the wood.

Trees or logs infested by this borer can be readily recognized by the pits (fig. 21, *a*) excavated in the bark by the female preparatory to depositing eggs.

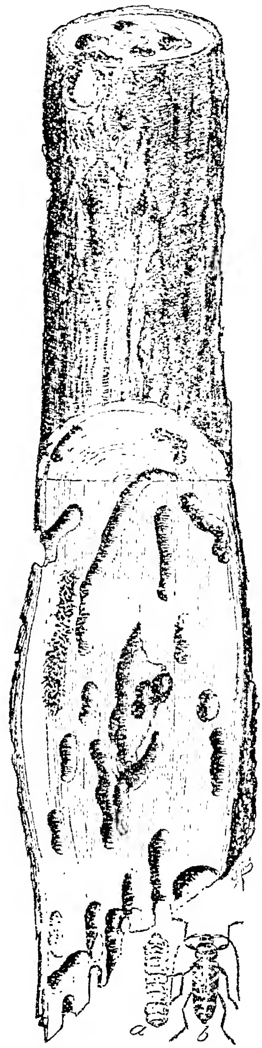


Fig. 22.—Work of the locust borer (*Cyllene robiniæ*). Section of trunk of dying locust, showing larval mines: *a*, Larva; *b*, adult. Insects natural size. (Original.)

THE LOCUST BORER.

(*Cyllene robiniæ* Forst.)

So important and destructive an enemy of the black or yellow locust has the locust borer become that in certain sections of the country the growing of these trees has been considered unprofitable because of the widespread depredations of the borer. Throughout the Eastern and Middle States scarcely a community where locust trees occur is exempt from this insect. Many trees are

killed outright, and in others the wood is generally reduced in value for commercial purposes.

So far as known, this species confines itself to the black or yellow locust. The borer is an elongate, compact, yellowish-white grub or larva furnished with three pairs of minute legs (fig. 22, *a*). Its first work is done in the inner bark, where it destroys a portion of the vital tissues. Later it enters the wood to feed and pupate. It is here that its most destructive work is done, either by so honeycombing the wood as to cause the death of branches or small trees or by injuring the wood for commercial purposes (fig. 22). The egg from which the borer is hatched is deposited by the adult female in a crevice of bark on the trunk or a branch, between the middle of August and the middle of October. The larva passes the winter in the bark, where it lies dormant in a hibernating cell of its own construction. In the spring (usually about the second week in April in the vicinity of Washington) activity commences again and the borer leaves the hibernating cell to feed on the inner bark and outer wood. In from two weeks to a month it enters the wood, where it continues to feed and later changes successively to pupa and adult (fig. 22, *b*). Adults begin emerging from the trees in August and continue emerging till the last of September, the principal period of emergence being the last half of August and first half of September. The adult is an elongate beetle, the ground color of which is black, with numerous cross-bands of yellow. Within a few hours after emergence copulation takes place and the females begin depositing eggs. There is but one generation a year.

The adults are usually common, feeding on the flowers of goldenrod while this plant is in bloom.

When infested trees are so badly damaged as to be worthless they should be cut down in May and June and burned to kill the broods of larvæ. At this time all such trees can be easily recognized by the boring dust which is thrown out by the larvæ and lodges in forks of trees, in crevices of bark, and on the ground underneath. They can also be recognized by the fading leaves, broken branches, etc. This work should be completed by the time the flowers have all fallen from the trees, or before the earliest varieties of goldenrod begin to show evidences of flowering.

Hibernating larvæ may be killed by spraying the trunks and branches with a strong solution of kerosene emulsion. This method is specially recommended for the protection of small plantations, groves, or shade trees. The work should be done in the fall or winter, not earlier than November 1 and not later than April 1.

Great care should be exercised as to the time of year when locust trees are cut for any purpose in order that the hibernating borers may be destroyed. Except for the purpose of destroying the borers in the

wood, cutting should always be done between the 1st of October and the 1st of April and the bark removed, and the tops and thinnings burned. When it is necessary to cut trees between the 1st of May and the middle of September, the tops should be burned and the logs either barked, or submerged in water for a few days before they are shipped or manufactured.[1]

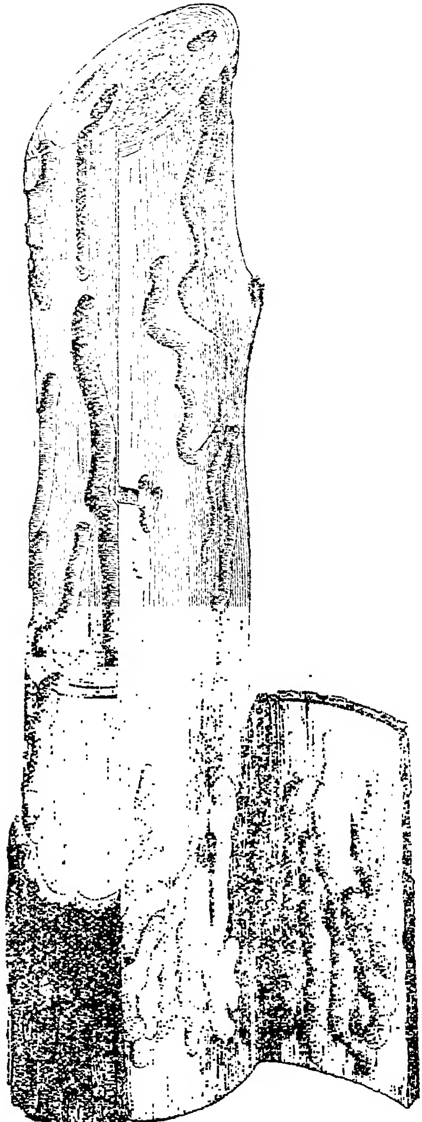


FIG. 23.—Work of the painted hickory borer (*Cyllene caryæ*). Section of hickory log showing larval mines. (Original.)

THE PAINTED HICKORY BORER.

(*Cyllene caryæ* Gahan.[2])

The painted hickory borer is a close relative of the locust borer and one of the commonest and most destructive borers in dead and dying hickory, the larval mines often riddling the sapwood and sometimes the heartwood as well. Besides hickory, it attacks walnut, honey locust, mulberry, and Osage orange, but never attacks the black locust. Its range appears to be coextensive with that of hickory.

The larva is a creamy white, compact grub and has three pairs of legs. The adult so closely resembles the adult of the locust borer (fig. 22, *b*) as to be, to the ordinary eye, indistinguishable from it. The seasonal history, however, is quite different from that of the locust borer. The adults fly and deposit eggs in May and June and do not appear at other seasons of the year. The egg is laid in a crevice of bark, and the young larva hatching therefrom proceeds to the inner bark and soon enters the wood. If a great number of larvæ

[1] See U. S. Dept. of Agriculture, Bureau of Entomology, Bul. 58, Part I, and Bul. 58, Part III.

[2] Known for many years under the name of *Cyllene pictus* Drury.

are present in the same piece of wood, the solid wood is often literally honeycombed with their mines (fig. 23). Pupation takes place in the wood and the adult beetle usually emerges in May or June of the year following that in which the egg is laid.

It has been found that hickory cut between August 10 and November 1 usually is not damaged by this borer. Therefore, where much damage occurs from this source, all cutting of green timber should be done as nearly as possible within this period. If it is absolutely necessary to do the cutting in the spring or early summer, the bark should be removed and the tops and useless branches burned.

THE BLACK-HORNED PINE-BORER.

(*Callidium antennatum* Newm.)

Injuries by the black-horned pine-borer to the bark or sapwood of dead or dying cedar, juniper, pine, and spruce are common generally over the United States. Often the timbers in rustic houses are found to be infested, and rustic work is especially liable to injury, since the presence of bark is absolutely necessary for the early development of the borer.

When first hatched from the egg the larva feeds exclusively on the inner bark, making an irregular winding mine. Later it also grooves the surface of the wood (Pl. XXIII) in making its mine, thus completely separating the bark from the wood, causing it to become loose and, in many cases, to fall off. As the essential part of rustic work is the bark, this sort of injury to it is quite a serious matter. The larva is an elongate, fleshy, yellowish-white grub, usually about a half inch in length when full grown. After working in the bark until a certain period of development is reached, the larvæ enter the wood and continue their mines there. Usually they do not go deeper than the sapwood, except in small stems or branches, where they may penetrate the heartwood. The larva pupates in the wood. The adult which finally emerges is a medium-sized, robust beetle, 9 to 14 mm. in length, blue to green in color throughout. There appears to be but one generation a year. Adults fly and deposit eggs during the months of April, May, June, and July. The winter is probably passed in the larval stage, the adults emerging the following spring.

As a preventive against injuries by this borer, cedar, juniper, pine, and spruce should be cut in the late summer, fall, or early winter. If cut during the period between January and August, the trees should be barked when felled. In the case of rustic work already in use when found to be infested, some relief may be secured by injecting bisulphid of carbon into holes in the bark through which sawdust-

like borings fall out, and stopping up the holes with putty or some kind of wax. The dropping of the sawdust-like borings from the logs or timbers always indicates the presence of this or a similar kind of borer.

THE CEDAR-TREE BORER.

(*Hylotrupes ligneus* Fab.)

The cedar-tree borer attacks dead and injured Douglas fir, arborvitæ, red cedar, redwood, western hemlock, Engelmann spruce, juniper, alpine fir, giant arborvitæ, white fir, bigtree, and Arizona cypress. In some cases living, healthy trees may be attacked and killed, and in other cases the death and decay of already unhealthy trees may be hastened by this borer. This species also seriously injures the wood of felled trees for commercial purposes and the bark and wood of those used for rustic work. Its occurrence is general over the United States where its host plants occur.

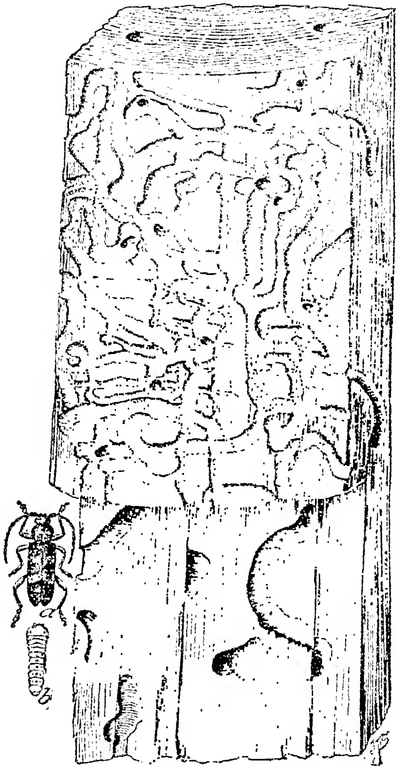


FIG. 24.—Work of the cedar-tree borer (*Hylotrupes ligneus*). Section of Arizona cypress showing larval mines. *a*, Adult; *b*, larva. Insects natural size. (Original.)

The larva (fig. 24, *b*) is a yellowish-white grub about half an inch in length when mature, tapering from the prothoracic segment to the last three abdominal segments, which are slightly larger than those immediately preceding. The adult (fig. 24, *a*) is a beetle varying from 7 to 16 mm. in length. The elytra or wing covers are sometimes marked with alternate transverse bands of red and black, and sometimes are entirely black or reddish brown. Apparently there is but one generation a year. The egg is laid in crevices of the bark in spring or summer. The larva hatching from the egg excavates a winding, irregular mine in the inner bark, scoring the wood, later entering the sapwood, and sometimes penetrating to the heartwood (fig. 24). Pupation usually takes place in the sapwood, but sometimes occurs

in the heartwood or even in the bark. It appears probable that the winter may be passed either in the larval, pupal, or adult stage, the larval stage evidently predominating. The period during which adults emerge is quite extended, apparently from March to September, inclusive, depending considerably on latitude and altitude and on the stage of development reached before hibernation began during the previous winter. The same period represents the time when eggs are deposited for another generation.

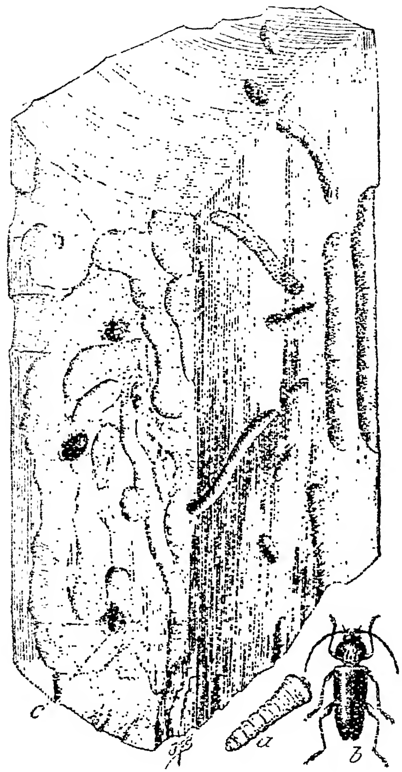


FIG. 25.—Work of the western cedar bark-borer. (*Hylotrupes amethystinus*). Section of incense cedar log, showing larval mines. *a*, Larva; *b*, adult; *c*, entrance hole of larva into wood. Insects slightly reduced from natural size. (Original.)

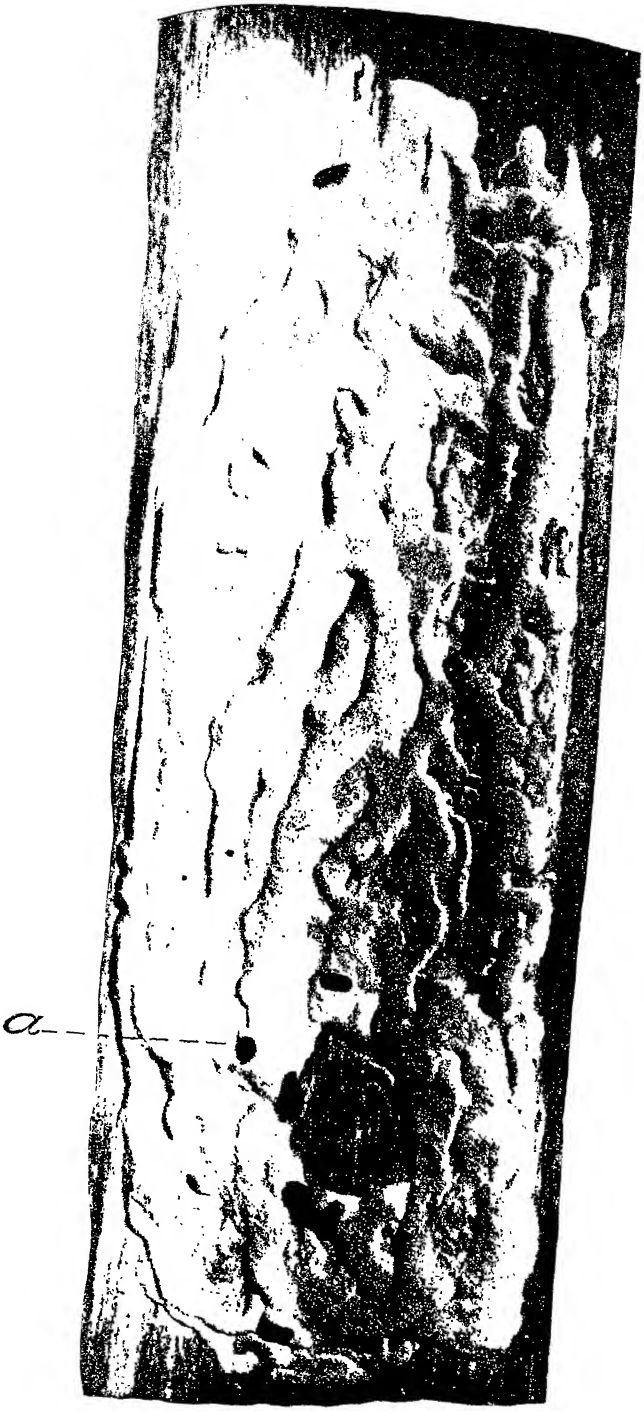
The usual preventive measures are recommended, i. e., removing the bark from trees when felled or treating rustic work as recommended for the black-horned pine borer, except those felled in late fall or early winter, which should not be injured by this borer.

THE WESTERN CEDAR BARK-BORER.

(*Hylotrupes amethystinus* Lec.)

The western cedar bark-borer is a relative of the preceding, the cedar-tree borer. Unlike the latter, however, its range is considerably restricted. The records of the branch of forest insect investigations, Bureau of Entomology, indicate that it is found only in the Pacific Coast States. It is of considerable economic importance, however, in injuring the bark and wood of recently felled giant arborvitæ and incense cedar.

The larva (fig. 25, *a*) is a large, fleshy, yellowish-white grub, provided with three pairs of feet. The largest larvæ are about 25 mm. long at maturity and about 8 mm. in width at the broadest part of the body, the prothorax. The adult (fig. 25, *b*) is a medium-sized to large, robust beetle, 12 to 23 mm. in length. The prothorax is black to reddish brown. The elytra, or wing-covers, are of a brilliant blue to violet color. The larvæ mine in the inner bark, making broad wind-



WORK OF THE BLACK-HORNED PINE BORER (CALLIDIUM ANTENNATUM).

[Section of spruce rustic work, showing larval mines on surface of wood. *a*, Entrance hole of larva into wood. (Original.)]

ing galleries and scoring the surface of the sapwood, sometimes almost entirely separating bark from wood. They finally enter the wood, sometimes mining to the heartwood, where the mine becomes longitudinal. Pupation takes place in either bark or wood, but usually in heartwood. It is probable that there is but one generation a year and that adults emerge and deposit eggs in July, August, and September.

The same recommendations for preventing injury as those given for the cedar-tree borer are applicable to this species.

THE BANDED ASH BORER.

(*Neoclytus capræa* Say.)

Numerous complaints have been received by the Bureau of Entomology regarding serious damage to ash lumber by the banded ash borer and closely related species. Of all species concerned, however, this is apparently the most destructive, the larvæ perforating the sapwood with their mines (fig. 26) and greatly depreciating its value, if not entirely ruining it. Besides ash, the borer attacks and lives in mesquite and, rarely, in white oak.

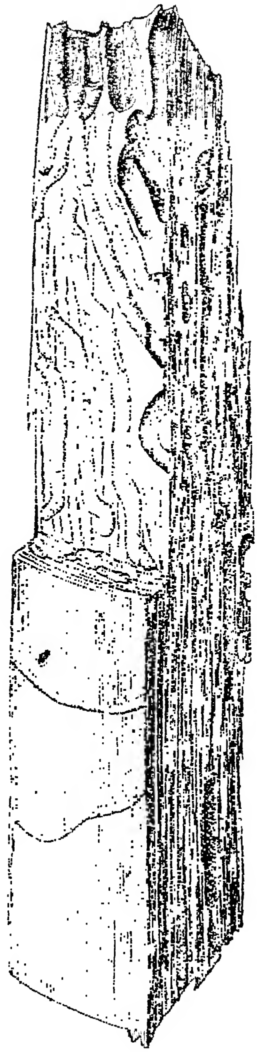


FIG. 26.—Work of the banded ash borer (*Neoclytus capræa*). Section of ash log showing larval mines (Original.)

The larva is an elongate, footless, fleshy white grub about an inch in length when mature. The adult is an elongate beetle, 15 to 18 mm. in length. The ground-color is black, with four yellowish-white bands on the elytra or wing-covers and one on the anterior border of the prothorax. The tips of the elytra are yellowish white. The female beetle deposits her eggs on the bark of dying or dead trees or logs. There is but one generation a year. The adults usually emerge and deposit eggs in March, April, or May. The larvæ mine in the bark and sapwood and pupate in the sapwood.

Ash trees cut in the summer, fall, or early winter are less liable to attack from this species than those cut in the spring, but even those cut in the fall are sometimes attacked the following spring. The best way to prevent injury to logs cut during the winter and spring, when the logs are

not to be immediately sawed into lumber, is to remove the bark immediately upon felling or between the 1st of March and 1st of June. Placing the logs in water after the larvæ have hatched and before they have entered the wood is also effective.

THE RED-HEADED CLYTUS.

(*Neoclytus erythrocephalus* Fab.)

The red-headed clytus is a close relative of the banded ash borer and does considerable damage to the wood of dead and dying ash, as well as to a number of other trees. The list of its host plants includes ash, hornbeam, hickory, maple, sweet gum, chestnut, cypress, hackberry, black walnut, dogwood, black oak, persimmon, peach, locust, sassafras, holly, mesquite, Texas redbud, pine, Kentucky coffee tree, lilac, honeysuckle, and grapevine.

FIG. 27.—Work of the red-headed clytus (*Neoclytus erythrocephalus*). Sections of hickory log showing: *a*, Larval mines on surface of wood; *b*, larval mines in the wood; *c*, entrance hole of larva into wood. (Original.)

The larva is a slender, white, footless grub of varying length when mature, the average length at this stage being, perhaps, about 15 mm. The adult is a slender beetle, 6 to 16 mm. in length. The head and prothorax are red. The anterior part of the elytra is reddish, shading into dark brown or black posteriorly. The elytra bear four pairs of yellow bands, the first pair being at the extreme base. There is but one generation a year. It appears that eggs may be laid anywhere from March to September. The adult female deposits the egg in a crevice of bark on a dead or dying tree or log. The young larva, hatching from the egg, mines first in the inner bark and later continues the mine in the sapwood, thus injuring the wood for commercial purposes (fig. 27). Pupation takes place in the sapwood. The adult emerges from the tree or log the following spring or summer after the egg is laid. This species is common from the District of Columbia to Ohio, and south to Texas.

The same preventive measures as those given for the banded ash borer apply to this species except, it will be noted, that the egg-laying period of this species is much longer than that of the banded ash

borer, so that there is scarcely any season of the year when trees may be cut and left with bark on, without danger of being damaged by this borer.

THE OAK PRUNER.

(*Elaphidion villosum* Fab.)

In the oak pruner we have a species which attacks only twigs or small branches on living and injured trees, causing them to break and fall to the ground. If occurring in large numbers it is of considerable economic importance, in retarding the growth of twigs and branches. Besides oak, this species attacks sassafras, black walnut, hackberry, sweet gum, hickory, and maple. Its range extends from Pennsylvania to South Carolina, and as far west as New Mexico.

The larva (fig. 28, *a*) is a very slender white grub about one-half inch in length. The adult is a slender, shining, brown beetle (fig. 28, *b*), 11 to 16 mm. in length, rather sparsely clothed with gray pubescence, each elytron terminating in two spines of about equal length. Adults fly in March, April, May, and June, during which time oviposition takes place upon the twigs or branches.

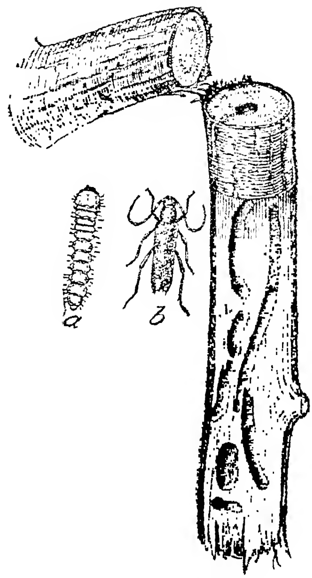


FIG. 28.—Work of the oak pruner (*Elaphidion villosum*). Oak branch which has been pruned, showing larval mines. *a*, Larva; *b*, adult. Insects natural size. (Original.)

The young larva, after hatching from the egg, first mines in the inner bark, then enters the wood and girdles the twig or branch by boring around it several times in the same place (fig. 28), leaving the bark and usually some of the wood intact. The larva then mines in the center of the twig beyond the girdle. The twig is usually broken off at the girdle by the wind and falls to the ground, carrying the larva with it. Pupation takes place in the center of the twig. There is apparently one generation a year, the adult usually emerging in March, April, May, or June of the year following that in which the egg is laid.

When this species occurs in large enough numbers to be injurious, the fallen twigs and recently killed twigs still on the trees should be gathered and burned in the fall in order to destroy the larvæ and pupæ in them.

THE HICKORY TWIG-GIRDLER.

(*Oncideres cingulata* Say.)

The work of the hickory twig-girdler, like that of the oak pruner, is confined to the twigs and branches, and is often quite injurious. Only living trees are attacked. The list of host plants includes hickory, basswood, poplar, dogwood, black gum, elm, persimmon, and acacia. The range of this species extends from the eastern United States to Arkansas and Kansas.

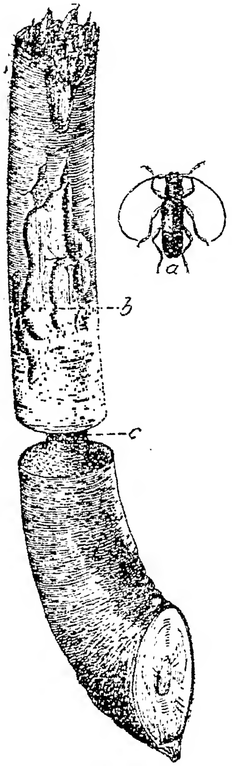


FIG. 29.—Work of the hickory twig-girdler (*Oncideres cingulata*) Acacia branch showing girdle, and larval mines in bark and outer wood. Insect natural size. (Original.)

The larva is a footless white grub about half an inch or more in length when mature. The abdominal segments, except the last two, bear minute granules, both above and below. The adult (fig. 29, *a*) is a stout beetle, 12 to 14 mm. in length, dark gray to reddish brown in color. The flight of the adults and the deposition of eggs usually occur in August or September. The adult female punctures the branch or twig and deposits an egg in each puncture. She then gnaws off the bark and outer wood at a point on the branch below where the eggs are laid, completely circling the limb and causing that portion of it beyond the girdle to die (fig. 29). The eggs hatch and the larvæ, after mining in the inner bark (fig. 29, *b*), bore to the center of the branch, where pupation takes place in the larval mine, little if any protective device in the way of a pupal chamber being made. Probably most of the infested twigs and branches fall to the ground before the larvæ complete their development, though some do not. It has been found that in the infested branches which do not fall the larvæ seldom complete their development to the adult stage unless the branches are in a shaded position. Likewise, few adults are produced from branches which are freely exposed to the sun after falling. This insect reaches its best development in shaded twigs or branches, or those partially covered by leaves or vegetation. In North Carolina the larvæ begin to pupate about August 1 of the year following that in which the eggs were laid, most of the adults probably emerging in September. The winter is therefore passed in the larval state.

The work of the insect is not confined to the large trees, but straight young seedlings from 4 to 10 feet high are sometimes attacked and the entire top taken off, resulting in the removal of about 2 feet of the new growth, usually nearly two years' increment. The adult beetle apparently injures the smaller twigs by feeding upon the bark without depositing eggs in them.

Where this species occurs in destructive numbers it is advisable to collect and burn the pruned twigs and branches. This should be done several times between October 1 and August 1 of the following year—once just before the leaves fall, once early in the spring before vegetation starts, and again in the summer during June or July. The twigs which first fall are quite apt to be almost hidden by fallen leaves and quite difficult to find in the spring.

SUMMARY.

In general, roundheaded borers are elongate, fleshy, yellowish-white grubs, which hatch from eggs deposited by the parent beetles in or upon the bark or wood of the host plant. The grubs finally change to pupæ and these in turn change to adults or beetles. The young adults in time emerge from the host and deposit eggs in or upon other host plants; and so the life cycle goes on. Usually there is but one generation a year, but in some species there may be two generations a year, and in other species it may take longer than a year for a single generation to develop.

Great damage is done to living and felled trees, and to standing dead trees, by this class of borers. In some cases the borers confine themselves to the bark, while in others they enter the wood. The remedy in each case depends upon the habits and character of work of the species under consideration.

The western larch bark-borer attacks perfectly healthy western larches, making winding, irregular galleries in the inner bark, thus cutting off the flow of sap and killing the trees. The methods of control are preventive. No attempt is made to save a tree which has once become badly infested. After becoming infested, trees should be felled and barked and the bark burned before the following May 15. A few healthy trees felled in May or June, near those infested, should attract the beetles which would otherwise deposit eggs in healthy trees. Before the following spring the bark should be stripped from these trap trees and burned.

The southern pine sawyer is very destructive to felled pine timber in the Southern States, making large, unsightly holes in the sapwood and greatly reducing in value a considerable percentage of each log infested. Injury by this species may be prevented in two ways. First, by placing infested logs in water while the larvæ are

still in the bark and before they have entered the wood; and second, by removing the bark from the logs before the larvæ have entered the wood.

The locust borer is a serious and destructive enemy of the black or yellow locust. Its first work is in the inner bark. Later it enters the wood, where its most destructive work is done, either by so honeycombing the wood as to cause the death of branches or small trees, or by injuring the wood for commercial purposes. Hibernating larvæ may be killed by spraying the trunks and branches with a strong solution of kerosene emulsion. Except for the purpose of destroying the borers in the wood, cutting should always be done between October 1 and April 1, the bark removed, and the tops and thinnings burned. When it is necessary to cut trees between May 1 and the middle of September the tops should be burned and the logs either barked or submerged in water for a few days before they are shipped or manufactured.

The painted hickory borer attacks dead and dying hickory, walnut, honey locust, mulberry, and Osage orange, the larval mines often riddling the sapwood and sometimes the heartwood as well. To prevent the spread of this species, all cutting of green timber should be done between August 10 and November 1. Timber which must be cut in spring or early summer should have the bark removed and the tops and useless branches burned.

The black-horned pine-borer is an enemy of dead or dying cedar, juniper, pine, and spruce. Rustic work is specially liable to injury from this source. As a preventive against injuries by this species, cedar, juniper, pine, and spruce should be cut in late summer, fall, or early winter. If cut between January and August the trees should be barked when felled. In the case of injuries to rustic work, an injection of bisulphid of carbon and the plugging up of the holes with wax or putty is recommended.

The cedar-tree borer attacks dead and injured Douglas fir, arborvitæ, red cedar, redwood, western hemlock, Engelmann spruce, juniper, alpine fir, giant arborvitæ, white fir, bigtree, and Arizona cypress. Like the black-horned pine-borer, it is injurious to rustic work. The usual preventive measures are recommended, i. e., removing the bark from trees when felled, or treating rustic work as recommended for the black-horned pine-borer.

CHEESE AND OTHER SUBSTITUTES FOR MEAT IN THE DIET.

By C. F. Langworthy,

Expert in Charge of Nutrition Investigations, Office of Experiment Stations.

INTRODUCTION.

Since earliest times meat has been a part of the diet of the human race, and rightly used is a wholesome food and a staple article of diet with the average family. However, physiologists admit that meat is not essential to a well-balanced diet, and there are many who, for one reason or another, are interested to know of rational ways of lessening the amount of meat which they consume or of replacing it with other foods. With the average family the problem is without doubt most often the occasional substitution of other palatable dishes for meat, either for reasons of economy or for the sake of variety in the diet or for some similar reason. Then, too, there are instances in which a meat-free diet is prescribed by a physician, and there are also to be considered the individuals who for one cause or another exclude meat from their diet. For all these reasons it is convenient for the housekeeper to know of foods or combinations of foods which, as occasion demands, may be substituted for meat without lessening the nutritive value or the attractiveness of the meal served.

Considered from the standpoint of the food value, meat is used in the diet to supply both nitrogenous material, or protein, and energy, the latter being derived largely from the meat fat. The proportions of protein or nitrogenous material and fat vary with the kind and the cut of the meat. At one extreme is such a cut as round steak, or the corresponding cut of veal, in which there is little or no visible fat. In such meat the percentage of protein is several times that of fat. At the other extreme are such meats as bacon and salt pork, in which the lean is found only in small strips. In these the fat greatly exceeds the protein.

Meat has another important use in the diet, since it supplies apparently a greater abundance than other foods of the substances which stimulate the normal or natural flow of the digestive juices. Then, too, it is important from the standpoint of palatability, since there is no doubt that the flavor of cooked meat, particularly when it is prepared in such a way that the fat and the juices are browned together, appeals to most palates. With most of us it is the piece

of broiled steak or the slice of roast which makes a meal, rather than the potatoes and bread and other foods which accompany the meat. No one can say just how far "good digestion waits on appetite," but physiologists agree that palatability is an important characteristic, and so when one looks for a reasonable substitute for meat in the diet, flavor must be considered as well as chemical composition, digestibility, and nutritive value.

The most usual substitutes for meat in the diet in the United States as well as in Europe are fish, milk, cheese, eggs, and such legumes as beans and peas. Nuts which contain an abundance of protein and fat are also substituted for meat and are used much more commonly as staple articles of diet in this country than was once the case.

Those who wish to make substitutions of these foods for meat often desire to know how much of each is necessary in order to replace a given amount of meat. If we consider only the proteins of the meat, the following general statement may be made: 2½ quarts milk, 1½ pounds fresh lean fish, three-fourths pound dried fish, two-thirds pound ordinary cheese, somewhat less than a pound of mixed nut meats, 9 eggs, one-half pound peanut butter, or two-thirds pint dry beans, peas, cowpeas, or lentils is equal to a pound of beef of average composition.

The ways in which these substitutes for meat can be used are numerous and varied. Individual taste and food habits are to be considered, but, in general, it is true that the relish with which other dishes are accepted in place of meat depends upon the ingenuity and skill of the cook. It seems a foundation principle that as meat is a savory dish, any acceptable substitute for it must also be savory or must be made so by suitable seasoning and proper cooking.

FISH.

Fish is used in place of meat to a greater or less extent in most households. In earlier times it was the common article of flesh food, and meat was the exception in many coast regions, as indeed is still the case in communities or regions where fishing is the principal industry. In Japan fish has been eaten almost to the exclusion of meat, for the reason that it has been readily obtainable in large areas, and the reverse has been the case with meat in a land with little game and few domestic animals available for food purposes.

Many experiments having to do with the nutritive value and the digestibility of fish have been reported and much has been written regarding its nutritive value. Such data have been summarized in a previous publication of the Department.[1]

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[1] U. S. Dept. Agr., Farmers' Bul. 85, Fish as Food.

Meat and fish are both flesh foods and are so similar in chemical composition and in methods of preparation that there is ample reason for the general feeling that they serve the same purpose in the diet and may replace one another at the convenience of the housekeeper and the preference of the family. The ways of preparing fish are so well known that they do not need mention in detail, but it is perhaps worth while to direct attention particularly to the food value and palatability of salt and smoked fishes as reasonably inexpensive articles of diet. Owing to their marked flavor, it is possible to make many palatable dishes which contain only small quantities of the fish, such as creamed smoked halibut, creamed codfish, or chowder made with salt fish. As flour or other cereal, milk, and the other materials used with the fish are usually cheaper than fish or meat, such a dish is manifestly much less expensive than a roast, and when rightly made is certainly palatable. If the simple creamed-fish dishes are not considered suitable for dinner, they may be made more elaborate by combining the fish with cream sauce, covering with crumbs, and baking, and there are, of course, many other dishes which can be made of salt fish. Creamed fish is often served with baked or boiled potatoes in place of meat. The savoriness of the salt or smoked fish makes it a favorite dish with many people, but its high nutritive value seems hardly to be appreciated. A quart of milk thickened with flour and mixed with one-half pound dried fish (codfish or finnan haddie) makes a compound which contains more protein than a pound of round steak and as much as 1½ pounds sirloin steak. The addition of hard-boiled egg, which is a common practice, still further increases the proteid value. Two eggs would bring the food value up to that of about 1¼ pounds round steak or about 1½ pounds sirloin steak. The fish dish would serve more persons than the steak and cost less.

EGGS AND MILK.

Eggs and milk are perhaps even more usual meat substitutes than fish, and every housewife knows how to prepare and use them in a great variety of dishes. If she is looking for a substitute for a meat dish she would perhaps more naturally think of eggs than of milk, partly because they are solid when cooked (and it is very common to regard a liquid as a beverage rather than a food), and partly because the cooked eggs, especially fried eggs, omelette, and other similar dishes, have a distinctive and pleasant flavor, owing in considerable part to the browned fat in which they are cooked. It is difficult to suggest more rational dishes than old-fashioned bread and milk, the mush and milk of the early American settlers, and the oatmeal and milk of the Scotch. In recent times the many specially prepared

breakfast cereals designed to be eaten with milk have to a large extent taken the place of the old-fashioned dishes and have approximately the same nutritive value. Such combinations are rational because the cereal, which supplies a fair amount of protein, is also specially rich in starch and supplies the fuel elements which milk lacks to make it a perfect food. For young children, eggs, bread, and other cereal foods and milk are generally regarded as staple foods, and most persons agree that they are better suited to the child than are heavy meat dishes.

Though fluid outside the body, milk becomes solid, i. e., coagulated or curdled, almost as soon as it enters the stomach. Its water content is high, unadulterated whole milk containing about 87 per cent of this constituent and 13 per cent solids, of which about one-fourth is proteid compounds (casein being the most abundant), one-third fats (butter fat), and the remainder carbohydrates and a small amount of mineral matter. The value of milk as food is not generally realized, for very many persons think of it, for adults at least, as a beverage rather than as a food, and do not realize that a glass of milk adds as much nutritive material to a meal as one-fourth of a loaf of bread or a slice of cooked beef. On the whole, milk is to be regarded as a reasonably nutritious animal food, and, furthermore, it is very thoroughly assimilated, as has been shown by many experiments.

Milk can be used in the preparation of a great variety of dishes which are palatable, wholesome, and generally relished, and while the milk and foods containing milk do not bear any great resemblance in appearance and flavor to meat, yet on the basis of composition and digestibility they may be used as reasonable substitutes for it. The importance of skim milk, which is whole milk minus part of its fat, should not be overlooked, for it may be used in place of whole milk in the preparation of a great many dishes. Since it costs only about one-half as much as whole milk, it furnishes protein much more cheaply than beef. The fat which skim milk lacks may be readily supplied if needed by using butter or less expensive fats.

Eggs resemble in composition such animal foods as meat, milk, and cheese. They are less concentrated, that is, they contain more water than cheese, but are more concentrated than oysters and milk. The average egg, which weighs about 2 ounces, supplies a little over 0.2 ounce protein and yields about 80 calories of energy, or much the same quantity as a gill of milk or 1 ounce of sirloin steak. With respect to their water content, they do not differ very greatly from the average value for lean meat. Egg yolk and white differ greatly in composition, the white containing somewhat less protein and about twice as much water as the yolk, and practically no fat and only a

very little ash. On the other hand, the yolk contains considerable fat and ash and is a richer food than the white.

The digestibility of eggs has often been a matter of study and it has been found that in this respect they compare favorably with other common foods, being as thoroughly digested as meat.

That eggs at a given price per dozen are cheaper than meat at an equal price per pound is very frequently true, since a smaller quantity will often serve a given number of people. It is well known that eggs require less time for cooking than most common foods, and would therefore also require less fuel. There are undoubtedly many cases in which a small saving of gas or other fuel in the preparation of a dish is important and there are many more cases in which a saving of time is a great convenience.

When eggs or milk are used with a view to lessening the amount of meat eaten, dishes should be selected which are relished by the family, particularly when substituted for meat as the principal dish at a meal. It should also be remembered that an abundance of milk, eggs, or both, in desserts or in other dishes, means that the amount of meat served can be correspondingly diminished without changing the kind and amount of nutrients served in the meal.[1]

DRIED BEANS AND OTHER LEGUMES.

It is very commonly said that dried legumes are rational meat substitutes, and indeed the dried legume is very rich in protein and energy constituents. It is interesting to remember that, in preparation for the table by the usual methods, the cooked legume becomes much less concentrated, owing to the water which has been added in cookery, while, on the other hand, cooked meats are usually more concentrated than raw, since water has been removed by heat, as in roasting or broiling. Dried peas and lentils are used in the United States and the peanut is also an important legume, but the principal legumes undoubtedly are beans and cowpeas, the former a staple legume of the Northern States as well as other regions and the latter a common food in the South. Both are wholesome, valuable, and nutritious foods, and may be prepared in many ways as the principal dish and served in place of meat. Such legumes are lacking in fat, so it is rational as well as natural to add the salt pork to the baked beans and bacon to the cowpeas. In using pork and beans or cowpeas and bacon in place of meat, it may be estimated that a pint of the dried lugumes and a half pound of the pork has as much protein as

[1] For additional data regarding the food value of milk and of eggs, see U. S. Dept. Agr. Farmers' Buls. 128, Eggs and Their Uses as Food; 363, The Use of Milk as Food; and 413, The Care of Milk and Its Use in the Home.

over a pound and a half of uncooked meat of average composition. This dish being rich in starch as well as in fat and proteins may serve as a substitute for potato and meat. Many of the uses of legumes have been referred to in a previous publication of the Department of Agriculture.[1]

In Eastern countries, where conditions differ from those in Europe and America, the lack of abundant supply of food animals has been responsible for the production of a series of food products made from legumes, chiefly the soy bean. By ingenious processes the nitrogenous material and more or less of the fat which the beans contain are separated and made into a number of special articles of diet, for instance, bean cheese or bean curd, a white material not unlike cottage cheese in appearance, and soy, a thick brown sauce which is the common flavoring material as well as condiment of millions of people who thus supply nitrogenous material and flavor to a diet of vegetables, rice, and other similar foods.

The use of bean protein separated from the cell walls and other fibrous material of the bean seems to be a very rational way of using legumes as the chief source of protein in the diet. At least this would appear to be the case from the data available regarding the use by Chinese, Japanese, and other oriental people of a diet in which specially prepared bean proteid products are very abundant in comparison with what has been observed in Bengal regarding a diet of cereals and pulse (legumes of different sorts) which are parched or pounded and cooked in various ways which do not involve the special separation of the protein from the other constituents.

Numerous experiments have shown that beans and other legumes when well cooked by such methods as are common in American homes, and when eaten in reasonable quantities, are well assimilated.

NUTS AND NUT PRODUCTS.

Nuts in general have a fairly low-water content and so supply a relatively high amount of nutritive material in proportion to their bulk. With the exception of the chestnut, which is rich in starch, the ordinary nuts are characterized by a high percentage of protein and fat. It is this which on theoretical grounds makes them so often discussed as meat substitutes.

Formerly nuts were eaten chiefly at dessert and at odd times. There has, however, been a growing tendency of late to use them in many different ways as staple articles of diet. Many families relish nut roasts and other nut dishes which can be served in place of meat, while sandwiches made with nut meats or peanut butter are very familiar, whereas only a few years ago such dishes were seldom, if

[1] U. S. Dept. Agr., Farmers' Bul. 121, Beans, Peas, and Other Legumes as Food.

ever, seen. An idea of the increased use of nuts may be gathered from their growing importance as commercial commodities.

Experiments which have to do with the food value of nuts have been reported and questions concerning their use in the diet have been considered in earlier publications of the Department.[1]

COMMERCIAL MEAT SUBSTITUTES.

There are on the market numbers of proprietary or patent foods recommended by their makers as meat substitutes. For some it is claimed that they are made from nuts, and judging from their flavor and other characteristics they may be prepared from the peanut or other nuts, in part at least. It has been suggested that some of these special foods contain wheat gluten. Undoubtedly considerable quantities of these foods are used by those who follow some one of the vegetarian systems of diet, but they are not used in any general way as substitutes for meat in the average home. As regards composition, some of these special foods supply reasonable proportions of protein and fat. In many cases their flavor is not very distinctive, but the matter of flavor is of course more or less a question of added seasoning, and skillful cooking would insure more palatable dishes than those which are sometimes served.

MUSHROOMS AND OTHER EDIBLE FUNGI.

Mushrooms are often spoken of by popular writers as very rich in nitrogenous material and so natural substitutes for meat, but such statements are not justified by studies of their composition. Mushrooms and other edible fungi, like more common succulent vegetable foods, contain a very high average of water—over 90 per cent on an average. The 10 per cent or so of nutritive material they contain is largely carbohydrates, though a little nitrogenous material is also present. Fat is almost utterly lacking. So it is obvious that the mushroom more nearly resembles in composition such a vegetable as carrot or turnip than it does meat. Mushrooms and some other edible fungi have flavor which to many palates suggests meat, oysters, or some other animal food. From the standpoint of flavor and palatability they are worth including in the diet, if they are relished, and alone or combined with other materials they can be served in dishes which suggest meat dishes in flavor and which satisfy the palate, while the nutritive value of the meal or the day's ration can be made up to the desired standard by the other dishes served at the meal with the mushrooms.

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[1] U. S. Dept. Agr., Office Expt. Stas. Buls. 107, Nutrition Investigations Among Fruitarians and Chinese at the California Experiment Station, 1899–1901; 132, Further Investigations Among Fruitarians at the California Agricultural Experiment Station; U. S. Dept. Agr., Farmers' Bul. 332, Nuts and Their Uses as Food.

CHEESE.

A food suitable to serve as a substitute for meat because of its composition and also because of its savoriness is cheese. It is probable that this food would have been used much more extensively if it had not been for the impression which prevailed in the past that it was indigestible and likely to induce intestinal disturbances. This theory has not been substantiated by the extensive experimental work done by the Department of Agriculture. On the other hand, the possibility of the use of cheese in quantity in the diet, and its wholesomeness when thus used, have been demonstrated.

Cheeses are of two general classes—those which are of mild flavor and those which are seasoned or ripened in such a way that they are highly flavored. The latter, like almost all highly flavored foods, are commonly used to season dishes made of ingredients without much distinctive flavor, or else are used in small quantities at a time to give palatability to a dish or a meal. The mild-flavored cheeses are the ones which are usually selected for eating in quantity and are the ones which may be most appropriately selected when cheese is considered as a substitute for meat with respect to quantity as well as the kind of nutritive material which it provides. The common mild-flavored cheeses in the United States are the ordinary factory or cream cheese (which is practically the same thing as English Cheddar cheese), cottage cheese, or sour skim-milk cheese and the commercial cheeses which are similar to it, the Swiss Gruyère, or, as it is commonly called, Swiss cheese, whether imported from Europe or of American make, and such foreign cheeses as Edam.

As regards the nutritive value of cheese and the problem of its use in quantity, the extended experiments on the digestibility of cheese carried on as a part of the nutrition work of the Department of Agriculture have shown that when eaten in quantity as an integral part of the diet and as a chief source of protein and energy in the daily food, it was very thoroughly assimilated. The experiments indicate that on an average over 95 per cent of the fat and over 95 per cent of the protein of the cheese are digested, and over 90 per cent of the energy is available for the body. These figures are practically the same as those obtained with meat and show that both foods are very thoroughly assimilated.

The experiments were made with young men in good health and the diet was made up of cheese of different sorts, but particularly of American factory or cream cheese cured for different lengths of time, eaten with bread and fruit. The amounts of cheese varied from about one-third to nearly one-half pound per person per day. It is interesting to note that though the experiments as a whole were long continued, the subjects did not tire of the diet and in no case was con-

stipation, indigestion, or other symptom of physiological disturbance noted.

That cheese may serve as the principal source of protein and fuel in the diet for a long period of time and prove satisfactory is also indicated by other data recorded in connection with the Department of Agriculture nutrition investigations. For the sake of such considerations as ease of preparation and relative economy, a young man lived for over two years on a diet of cheese, bread, and fruit such as pears and apples. He did not make a practice of regulating the quantities which he ate, but governed his diet by his appetite. The cheese used was the cream cheese or factory cheese, which is commonly found in the Washington market, and the bread selected was the usually so-called whole-wheat bread made by local bakers. For the sake of securing accurate data weighings were made for a short time of the quantities eaten, which averaged 9.27 ounces of cheese, 2 pounds 2 ounces of fruit (pears), and 1 pound 1 ounce of baker's whole-wheat bread per day.

On the basis of average values for composition it was calculated that this diet supplied 0.25 pound (113 grams) protein, 0.22 pound (100 grams) fat, and 0.33 pound (376 grams) carbohydrates per day, the energy value being 2,890 calories, quantities which are in fair accord with the dietary standards suggested by the Department of Agriculture. As previously noted, the diet was voluntarily selected and the quantities eaten were governed by appetite. The young man had a fair amount of muscular work, was apparently in good health, and did not tire of his diet.

The idea has been advanced that the infiltration of casein with the fat which it contains renders cheese difficult of digestion, at least in the stomach, since the fat hinders the access of the gastric juices to the casein. Presumably, the larger the portions of cheese swallowed the more pronounced this would be. Such reasoning offers a probable ground for the belief that cheese should be thoroughly chewed before it is swallowed. To insure fine division, it has been suggested that it is desirable to grate cheese. Perhaps such suggestions may be appropriate for some sorts of cheese, but the fact that no physiological disturbances were noted in the Department of Agriculture experiments, when American full-cream cheese and some other sorts were eaten like any other food without such special precautions, would indicate at least that ordinary cream cheese or factory cheese is not particularly difficult of digestion in the stomach. As Hutchison [1] points out, a possible reason for the disagreeable effects, such as a burning sensation and other symptoms of indigestion, which certain kinds of cheese sometimes produce in the stomach, is that in the ripening process of cheese small quantities of free fatty acids are

[1] Food and the Principles of Dietetics. London, 1901, p. 145.

produced and such acids are irritating. General experience seems to bear out these statements, which would of course be more applicable to strong cheeses used as condiments than to mild cheeses used as a staple article of diet. Figures are sometimes quoted regarding the rapidity of the digestion of cheese, but, as is usually the case, these of course refer simply to the time that the cheese remains in the stomach. For persons in health, apparently it is not a matter of much importance whether the food remains a little longer or a little shorter time in the stomach. Whether or not some kinds of cheese occasionally cause some distress while in the stomach, there seems no indication that cheese is responsible for digestive disturbances in the intestine where the fat and any portions of the casein which have escaped digestion in the stomach are almost completely absorbed.

Interesting data have also been reported regarding the digestibility and food value of cottage cheese. In experiments carried on at the Minnesota Experiment Station cottage cheese furnished from about one-half to two-thirds of the total protein and not far from one-fourth of the total energy of a simple mixed ration.. Ninety-five per cent of the protein in the diet was digested and 90 per cent of the energy was available. This of course means that the cottage cheese, which made up so large a part of the diet, was well digested. From the experimental data the conclusion was reached that cottage cheese made with skim milk and enriched with cream "is a cheap, digestible, and nutritious food, and when the materials for its preparation are produced on the farm it is one of the most economical foods that can be used. At 2 cents per quart for skim milk and 35 cents per quart for cream, cottage cheese compares favorably with meats at 11 cents per pound."

To eat cheese with bread or with other foods is of course the most simple way of using it as a meat substitute and forms a common meal with many laboring men in Europe where mild-flavored cheeses are abundant. In earlier times in the United States cheese with crackers, purchased at the grocery store, was a common lunch for the farmer who came to town with a load of produce and was a wholesome and rational meal, which was commonly made more palatable by the handful of rasins eaten with it.

Most of us are accustomed to hot meat dishes and so would naturally prefer as a meat substitute some hot dish to such simple combinations as bread and cheese, and owing both to its consistency and flavor cheese is particularly well adapted to the preparation of such dishes.

An extended study of the subject made by Miss Caroline L. Hunt, as a part of the nutrition work of the Office of Experiment Stations, has made it clear that the fundamental methods of cooking cheese are after all not very numerous and that the large number of dishes

which are known to the housekeeper fall into a comparatively small number of groups. These groups include the dishes of a sauce or custardlike consistency in which cheese is combined with such materials as milk and eggs and with flour or other thickening material; cheese fondue, croquettes, and other similar dishes in which cheese is combined with a fairly large proportion of flour or some other starchy food like rice; vegetable dishes such as potatoes or cauliflower, "au gratin," the cheese being added chiefly for the flavor which it supplies, though of course it adds fat and protein even if the cook does not realize it; cheese pastry, such as cheese straws and cheese patties, in which the cheese is combined with the dough or similar material; and toasted cheese, melted cheese, cheese omelet, and similar dishes. Mention should also be made of the cheese cakes so common in England as desserts, in which cheese or curd is combined with various ingredients as a custardlike filling for tarts or pies.

In the course of the study of cheese dishes made by Miss Hunt in the Office of Experiment Stations and referred to above, an attempt was made to standardize and to reduce the cost and also the fat content of cheese fondue, whose ingredients are usually milk, bread crumbs, cheese, butter, and eggs, by substituting skim milk for whole milk and omitting the butter. In this way a recipe was reached for a dish which contained almost exactly the same amount of protein and also had almost exactly the same fuel value as a pound of meat and a pound of potatoes. The ingredients for this dish were 1 cup of skim milk, $1\frac{1}{3}$ cups of bread crumbs, $1\frac{1}{2}$ cups or 6 ounces of grated cheese, and 4 eggs. Estimating the cost of a quart of skim milk as 3 cents, and supposing bread is 5 cents a loaf, cheese 25 cents a pound, and eggs 25 cents a dozen, the cost of this dish would be 18 cents, and would serve six people. When beef is 20 cents a pound and potatoes a dollar a bushel (i. e., 2 cents a pound), a meal or course composed of a pound of each of them would cost 22 cents, and would serve fewer people than the cheese dish.

In connection with the nutrition investigations of the Office of Experiment Stations, experiments have also been made by Miss Hunt on combinations of legumes and cheese which are promising as meat substitutes both from the standpoint of nutritive value and of palatability. Such a dish may be made, for instance, by combining grated cheese, bread crumbs, and finely mashed, cooked, red kidney beans in about the proportion of two parts each of cheese and of bread crumbs to four of beans. The mixture should be seasoned with salt and pepper and finely chopped onion or any other seasoning which is preferred, and formed into a roll and baked, with frequent basting. When thus prepared and served with tomato sauce or some other well-seasoned sauce, it is very similar in flavor to a meat loaf and

closely approximates it in chemical composition. If preferred, the mixture may be baked as a flat cake, which of course results in a large proportion of brown crust.

In a similar way a loaf may be made of white beans cooked and mashed, bread crumbs, and cottage cheese, such a dish being particularly palatable when seasoned with a little finely chopped parsley, celery, and chives or onion. If the above roll is made with one can (20 ounces net) of red kidney beans, 1 cup or 4 ounces of grated cheese, 1 cup or 2½ ounces of bread crumbs, and 1 tablespoonful of butter, its composition and also its fuel value are almost identical with these factors for a pound of round of beef with a pound of potatoes, and the cheese dish would also serve a greater number.

CONCLUSIONS.

The housewife who wishes to substitute with greater or less frequency some other food for the meat dishes ordinarily served has a number of food materials at her disposal which will answer the purpose. The most common are undoubtedly fish, milk, dried beans, and other similar legumes, and cheese. Most persons relish meat, and it is doubtless true that the palatability of the diet for the majority is quite largely determined by the meat dishes. It is therefore desirable in substituting other foods for meat to take especial pains to serve palatable dishes which are relished by the members of the family, as well as materials similar to meat in composition and digestibility.

The ways of serving fish are in general the same as those for meat. There are numerous palatable dishes in which eggs or milk are used which are well fitted to supply protein and energy in palatable form. The high nutritive value of beans, cowpeas, and other dried legumes makes this class of foods especially useful as substitutes for meat of vegetable origin. It is usually the custom to add considerable fat in cooking legumes.

The results of extended experiments made in connection with the nutrition work of the Department of Agriculture have shown that cheese, particularly mild-flavored sorts, can be eaten in quantity for long periods of time without physical disturbance, and that cheese is very thoroughly assimilated. Owing to the large amount of protein and fat which it contains, cheese is well suited to serve as a substitute for meat. Many palatable dishes can be prepared in which cheese is the principal ingredient, and it can also be used in a variety of ways to season dishes made from materials lacking distinctive flavor.

THE VALUE OF THE SHELLFISH INDUSTRY AND THE PROTECTION OF OYSTERS FROM SEWAGE CONTAMINATION.

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STATISTICS SHOWING EXTENT OF THE INDUSTRY.

The shellfish industry of the United States covers vast areas of submerged lands along the Atlantic and Pacific coasts. These tracts vary in width from 1 to 5 miles or more, according to the contour, comprising numerous indentations of the shore line. In the Chesapeake Bay and its tributaries alone there are said to be more than 175,000 acres well adapted to the growing of oysters.

It is estimated that approximately 25,000,000 bushels of oysters, valued at nearly $20,000,000, were marketed in this country during the year 1902, and these figures may be underestimated. According to the statistics of the New York State Forest, Fish, and Game Commission, there are more than 6,000,000 bushels of oysters marketed annually in New York City alone, valued at $7,000,000, and about 45,000 bushels of clams, worth nearly $90,000. The value of the escallop crop of New York for 1904 is estimated at the round sum of $200,000.

According to the report of the Rhode Island State Commissioners of Fisheries for 1910, $111,883 was due that State on January 1, 1910, for rental on 16,814 acres of shellfish grounds. The report of the Virginia Commission of Fisheries for the year ending October 1, 1909, shows that there were paid to the auditor of public accounts $76,693.76 from the fish and oyster revenues for the year ending September 30, 1909. The State of Virginia is said to possess approximately 400,000 acres of oyster grounds suitable for planting purposes; only about 75,000 acres, however, are considered as very desirable for this purpose.

Recent statistics show that the annual oyster crop of New Jersey is valued at $2,250,000, representing about 3,600,000 bushels. The clam output amounts annually to 625,000 bushels, valued at $608,000, or about 23 per cent of the total production of the United States.

Value of oyster industry in largest oyster-producing States.[1]

State.	Year.	Kind.	Amount.	Value.
			Bushels.	*Dollars.*
Rhode Island	1905	Market and seed oysters	916,088	929,963
Connecticut	1905	Seed oysters	2,551,725	1,603,615
		Market oysters	1,135,699	1,206,217
New York	1904	Private areas	2,847,702	6,230,558
		Natural reefs	20,805	
New Jersey	1904		2,135,127	1,691,953
Maryland	1904		4,429,650	2,417,674
Virginia	1904		7,612,289	3,459,676
Mississippi	1902		2,405,132	426,222
Louisiana	1902		1,198,413	493,227
Texas	1902		343,113	100,359

[1] Statistics of the Fisheries of the New England States for 1905. U. S. Department of Commerce and Labor, Bureau of Fisheries Document No. 620, p. 82.

Statistics of the Fisheries of the Middle Atlantic States for 1904. U. S. Department of Commerce and Labor, Bureau of Fisheries Document No. 609.

Statistics of the Fisheries of the Gulf States for 1902. Extract from U. S. Commissioner of Fish and Fisheries Report, 1903, pp. 411–481.

The extent of the industry is further revealed by the large number of men and women employed in the various phases of this business, the hundreds of boats and vessels used, and the cost of appliances and equipment necessary to carry on this kind of work.

THE OYSTER-CANNING INDUSTRY.

The industry of canning oysters was inaugurated in this country about 1822 near Baltimore, Md., which was selected because of its close proximity and easy access to the extensive oyster beds of Chesapeake Bay. For many years more oysters were canned at Baltimore than elsewhere, but according to recent statistics some of the Southern States, notably Mississippi, lead in this industry. In early times some difficulty was experienced in opening oysters by hand for canning purposes. However, this was later overcome by steaming the unshucked oysters from 10 to 15 minutes in boxes, which process greatly facilitates the removal of the oyster meat from the shell by means of a knife. The shucked oysters are then washed and packed in cans, weighed, passed through an exhaust chamber, sent to the capping machine, vented, and returned to the processing kettle, where they are sufficiently heated to destroy any organisms contained within the cans. Subsequent to this processing they are cooled, labeled, and packed for shipment. (Pl. XXIV, fig. 1.)

The following table shows the extent of the oyster-canning industry:

Canning and preserving oysters in the United States.

Number of establishments	69
Capital	\$2, 599, 563
Salaried officials, clerks, etc., number	186
Salaries	\$120, 867
Wage-earners, average number	3, 291
Total wages	\$547, 909
Men 16 years and over	906
Wages	\$282, 857
Women 16 years and over	1, 632
Wages	\$195, 514
Children under 16 years	753
Wages	\$69, 538
Miscellaneous expenses	\$232, 594
Cost of material used	\$2, 590, 872
Value of products	\$3, 986, 329
Value of canned or preserved oysters exported, 1905	\$633, 430

The term " cove oyster " was originally applied to oysters gathered from coves on the west side of the Chesapeake Bay and which were famous for their size and quality. This meaning, however, has been lost and the term is now used to describe the ordinary canned oyster largely sold to " landlubbers " far distant from the place of packing.

The following table shows the principal States engaged in the oyster-canning industry:

Quantity and value of canned oysters, by States (canning season of 1904).

State.	Number of cases.	Value.
Mississippi	457,339	\$1,340,942
South Carolina	192,133	529,511
Louisiana	148,452	507,373
Maryland	138,878	548,646
Georgia	99,881	256,750
California	73,640	222,617
North Carolina	52,629	144,273
Florida	37,532	125,600
All others	33,271	123,700
Total	1,233,755	3,799,412

GROWING THE OYSTER.

The term " oyster farm " would undoubtedly sound strange to the individual residing far from the coast; however, many entire families are devoting their lives to the work, and, in fact, have been in this business for several generations and are trained in no other trade. The area of these tracts of land varies in size as many of

the New England farms, and they are cared for and watched over with as much zeal and consideration. In recent years the industry has developed largely from the artificial beds rather than from the natural ones, and this is especially true of the northern oysters. The farms may be either leased or purchased at so much per acre from the State, and they are platted and staked out so that each tenant knows the boundaries and extent of his farm as does any dry-land agriculturist. The depth of water covering these tracts of land varies greatly. During low tide some areas become entirely bare, leaving the oyster exposed (see Pl. XXIV, fig. 2), while in other regions the water may range from 10 to 50 feet, or be still deeper in certain localities. The deep-water oysters are usually gathered by means of dredges operated by wind or steam power, while either the dredge or tongs may be used where the water is more shallow.

SEED OYSTERS.

Like other mollusks, the oyster reproduces by eggs. Each spat oyster is said to produce more than 1,000,000 ova in a single season.

For a brief period after hatching, the free-swimming larvæ are carried about in the water by tides and currents for long distances from their native haunts. Many never mature, as they are destroyed by cold and by living enemies. When about 2 weeks old the young "spat" have secreted shells of sufficient weight to cause them to gravitate to the bottom of the beds, where they "set" on any object with which they come in contact. The young set at this stage closely resembles the San Jose scale in size and appearance. At the end of one season the individual oyster has grown to the size of a man's thumb nail (see Pl. XXV).

TRANSPLANTING OYSTERS.

Thousands of bushels of seed oysters are sold annually for transplanting purposes. They are taken from localities less favorable for their development and placed in waters where the conditions are suitable for rapid growth to maturity. The appearance, size of the shell, and flavor of the growing oyster are modified according to environment.

Many small oysters are shipped to the Pacific coast and transplanted. In that section the industry is rapidly increasing, but the conditions are unfavorable for spawning and the proper development of the native oyster.

From 45,000 to 50,000 seed oysters are required to fill an ordinary flour barrel. An average carload contains from 150 to 180 barrels of seed oysters, which amount is sown over an area of about 5 acres. Within two or three years the seed oysters thus transplanted have grown to a sufficient size for market purposes. The average oyster

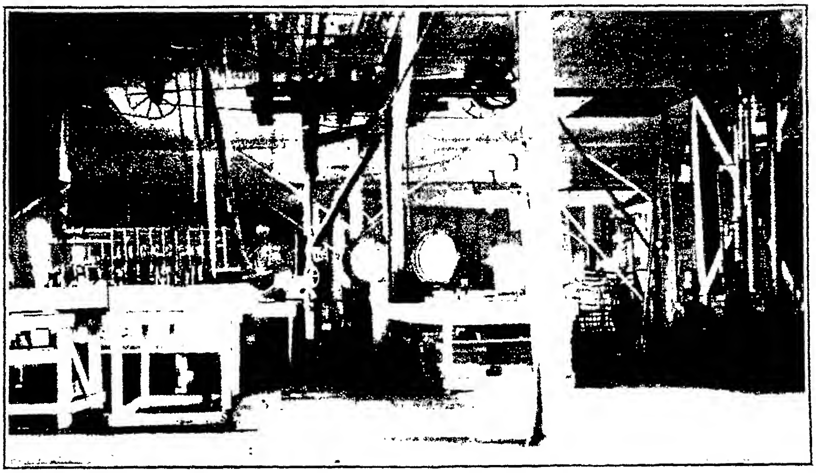

FIG. 1.—AN INTERIOR VIEW OF AN OYSTER CANNING ESTABLISHMENT.

FIG. 2.—RAKING OYSTERS DURING LOW TIDE, WHEN SHELLS ARE PARTIALLY EXPOSED.

SEED OYSTERS—ONE YEAR OLD.

[Natural size.]

when consumed is from 3 to 5 years old. Oysters taken from colder regions and placed in warmer waters, where the food supply is plentiful, develop very rapidly.

The food of the oyster consists largely of diatoms and other minute organisms such as desmids and infusoria; pollen of plants may also have some food value.

It is estimated that about 40 per cent of the oysters in the United States are obtained from natural beds, and the remainder are transplanted where the oyster does not breed or grow to advantage. The sowing is done principally during the spring months.

The United States Bureau of Fisheries is actively engaged in studying the localities best adapted for oyster culture. This information is acquired by numerous investigations to determine the food value of different waters, the specific gravity, the character of the floor of the sea, temperature conditions, freshness of the water, etc. Many native beds are rapidly becoming exhausted and the artificial ones must soon replace them in order to furnish an adequate supply to meet the increased demand.

ENEMIES OF THE OYSTER INDUSTRY.

NATURAL ENEMIES.

Considered from the oysterman's standpoint, the recognized natural enemies of the shellfish industry are the starfish, periwinkle, borer, conch, and drumfish. Mussels are sometimes also considered an enemy, since they may be attached to the growing oyster shell in large numbers, depriving the oyster of the sustenance which otherwise would be gained. Mussels also inhibit the growth of oysters by crowding, which interferes with their unrestricted development.

Young oysters may be destroyed by "sanding" or smothering from severe storms, or they may be killed by freezing in shoal water where the winters are long and rigorous. In such localities the oysters are removed to deeper water before the advent of cold weather.

Starfish are generally caught by dredging over the beds with specially constructed mops in which large numbers may become entangled and removed from the water without difficulty. Starfish feed on the young growing oysters by surrounding them with their rays or arms and sucking their body juices. Wire fences or other devices are sometimes resorted to in different localities to protect the beds from drumfish and other enemies.

SEWAGE.

From a public-health point of view the most serious menace to the shellfish industry to-day is the promiscuous discharging of sewage into natural bodies of water. Years ago, when present-day cities were

villages, there was no apprehension regarding the possibility of danger from the wastes of man. A new condition of affairs now confronts the industry. The proper care and disposal of sewage is fast being recognized as essential to the preservation of the shellfish industries by those who have seriously considered the problem.

Unless heroic measures are at once adopted, the problem will continue to grow in magnitude and in the same relative proportion as the increase of population of those cities discharging their wastes into waters coming in contact, directly or indirectly, with shellfish grounds.

From a sanitary point of view, shellfish reflect the character of the water in which they are grown. If the water is free from objectionable evidence of pollution, the shellfish will likewise show a corresponding degree of purity. The converse is true when water bathing shellfish grounds is contaminated with sewage. Invariably serious evidence of pollution is found in the case of oysters taken from grounds known to receive the wastes of man's activities.

EVIDENCES OF POLLUTION.

During the last three oyster seasons there have been examined in the bacteriological laboratory of the Bureau of Chemistry more than 1,000 samples of oysters, clams, and water taken from representative shellfish layings along the Atlantic and Gulf coasts. The following tabulated data illustrate how the results obtained indicate the purity or pollution of the samples and show the confirmation of the bacteriological findings by the sanitary inspection:

Bacteriological findings on shellfish, showing confirmation of results by inspection.

Number and kind of sample.	Organisms per cubic centimeter (plain agar, for three days).		Gas-forming organisms in ox bile.	Results of bacteriological examination and sanitary inspection.
	At 25° C.	At 37° C.		
Oysters:				
No. 1	3,800	410	1 oyster out of 5 showed gas in 1 c. c.	Judged to be good; inspection satisfactory.
2	10,500	4,400	2 out of 5 in 1 c. c.	Do.
3	10,100	1,900	1 out of 5 in 1 c. c. and in 0.1 c. c.	Do.
4	1,000	470	5 out of 5 showed gas in 1 c. c. and in 0.1 c. c.; 2 in 0.01 c. c.	Condemned; inspection showed very insanitary conditions.
5	75,000	20,000	9 out of 9 in 1 c. c.; 8 in 0.1 c. c.; 4 in 0.01 c. c.	Do.
6	200,000	40,000	10 out of 10 in 1 c. c.; in 0.1 c. c. and in 0.01 c. c.	Do.
Clams:				
No. 7	12,000	1,000	2 clams out of 5 showed gas in 1 c. c.; 1 in 0.1 c. c.	Judged to be good; inspection satisfactory.
8	30,000	19,000	5 out of 5 showed gas in 1 c. c.; 4 in 0.1 c. c.	Condemned; inspection showed probable pollution.

The water bathing the grounds from which samples 1 to 3 were taken showed no gas-producing organisms in 1 c. c. or 0.1 c. c. quantities, duplicates being planted in ox bile. The results given for the condemned samples, especially No. 4, show that it is not always the number of bacteria which prove pollution, but rather the presence of relatively large numbers of gas-producing organisms of the *B. coli* group which indicate fecal contamination. This sample was taken from a river near a large city at a point where untreated sewage was discharged.

Thus it is seen that raw oysters not only reflect the character of the water from which they are taken, but their consumption is attended in a measure by the same dangers as drinking the water from the locality where they grow. This shows the necessity of keeping the water flowing over oyster layings of the same degree of purity as that demanded for potable purposes.

REMEDIES FOR CONTAMINATION.

There is but one way to correct the evil of contaminated shellfish. The shellfish must be either removed from sewage-polluted grounds or else the wastes must not be permitted to flow into the waters which would in any manner affect the purity of the water bathing these layings. Oysters, however, when grown in polluted waters, may be removed and placed in water free from pollution for a season, thus giving them ample time to cleanse themselves, which they readily do when opportunity is afforded.

When the shellfish interests are small and the difficulties great in properly caring for sewage, the logical action seems to be the removal of the shellfish. However, there are many other reasons, aside from the shellfish interests, why natural bodies of water should be protected against sewage pollution. The general health of any community is made better by good sanitary environment, and the purity of the drinking water of every city is an extremely important factor in its future history. Disease may even be contracted by bathing in impure water. In some localities the sewage has literally killed the fish, where once the streams afforded a plentiful supply. From the esthetic standpoint alone, some of our once beautiful bodies of water have been ruined for boating and other pleasurable purposes, all because these places have been used as cesspools and dumping grounds for all sorts of factory and human waste.

The shellfish industries of the United States are extremely important in furnishing a source of food supply for millions of people, and these industries should receive the proper care and protection against sewage pollution, so as to place them on a plane above any possibility of unwarranted criticism.

There are numerous instances on record where infected raw shellfish have been held responsible for the causation of typhoid fever, gastro-enteritis, and other intestinal disorders. In most cases the difficulty has been traceable to oysters which had been "floated" in polluted water. This process generally consists of taking the oysters while in the shell from their natural beds and placing them in water containing a lower salt content than that required for their development to maturity. The oysters are placed on rafts constructed with false bottoms, which are usually located near the shucking establishment. Here they remain for one or two changes of tide, permitting the fresher or "brackish" water to "plump" them, resulting in whitening the oyster, increasing its size, and reducing its salt content. There is no objection to "floating" or "drinking" oysters in pure waters having the same salt content as that in which they have grown to maturity.

Although ordinary cooking may reduce the bacterial content of oysters, it does not kill all disease-producing organisms. In order to have raw oysters free from pollution they must be grown on beds or floated in waters not subject to sewage contamination, and they must be opened in a sanitary manner, placed in clean containers, washed in pure iced water, and kept properly cooled until ready for consumption.

THE MIGRATORY MOVEMENTS OF BIRDS IN RELATION TO THE WEATHER.

By Wells W. Cooke,
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INTRODUCTION.

Accurate knowledge of the periodic movement of birds is essential as a basis for intelligent study of their economic relations, and is equally necessary for intelligent effort for the protection of migratory species—two subjects which form important parts of the work of the Biological Survey. Ever since its organization the Survey has devoted much attention to collecting data on food habits and migration, and interest in these investigations is widespread. Thus more than 2,000 observers in the United States and Canada have contributed notes on bird migration. Some of these notes cover only the dates of arrival of a few birds for a single season, others form an elaborate résumé of both spring and fall migration at a given locality for 25 years or more. The whole, aggregating more than 400,000 records, forms the largest mass of migration data ever assembled in this country.

To ascertain the relation of bird migration to the weather, two things are essential: (1) Records for many years of the times of arrival of birds, made by a thoroughly reliable and competent observer constantly in the field; (2) observations taken in a district without mountains or valleys, which might interfere with the course of migration.[1]

MIGRATION WAVES AND TEMPERATURE WAVES.

In the middle of May, 1882, the whole city of Washington swarmed with large flocks of brilliantly colored birds. Scarlet tanagers, orchard orioles, and rose-breasted grosbeaks by the score flitted through the Mall and flashed among the trees of parks where ordinarily a half dozen would be a full season's quota. Rare species were common, and among them were warblers never before seen in Washington in spring. Even the Cape May, the mourning, and the

[1] In the first part of this article use has been made of the notes of Dr. J. C. Hvoslef, of Lanesboro, Minn., who contributed excellent memoranda for 10 consecutive years. His work was supplemented by that of several other observers immediately south of Lanesboro. The latter part of the article is based on the combined records of all our migration observers.

Nashville warblers, the rarest of the regular migrants, were not uncommon. What had happened? A "bird wave" had met an unfavorable "weather wave" and its progress had been temporarily arrested. It was the height of the migration season, when untold

FIG. 30.—Northward migration of the summer warblers, compared with the advance of spring.

thousands of aerial voyagers were speeding along the main chain of the Alleghenies toward their summer homes. Suddenly they were met by a sleet storm of such severity as not only to block their further northward progress, but to force them to descend from the

mountains to the shrubbery of the Coastal Plain in order to obtain food. The storm continued to the north of Washington for more than a week, while in the South fair weather tempted additional thousands to continue their migratory flight until they reached the inhospitable zone. The result was a "tidal wave" of birds never before or since equaled in the neighborhood of Washington.

This is a striking illustration of the fact that bird migration occurs in what may fitly be called "waves." Moreover, the relation of the weather to bird waves is that of cause and effect. Disconnected bird parties traveling northward are arrested by a cold snap, and succeeding swarms are similarly delayed until a great migrant host is waiting to continue its progress northward as a pronounced "bird wave."

It is not to be understood, however, that bird waves and temperature waves are always synchronous. Indeed, if a chart showing the weather waves at a given place for a series of years is compared with a similar chart showing the bird waves, the lack of uniformity is such as to suggest that there can be no relation between migration movements and the weather. Thus one season at Lanesboro, Minn., during the first week in May, the temperature was above normal and a great bird wave flooded the woods with songsters. The next year the same species came five days earlier, apparently because of a warm wave that carried the mean temperature far above the average. But the following year one of the most pronounced bird waves of the season occurred on the last day of April, when, although the temperature was far below normal, the birds arrived almost a week ahead of their usual dates; and notwithstanding the continuance of cold weather for the next three weeks, the birds kept coming, two-thirds of them earlier than usual. The largest bird wave ever recorded at Lanesboro, Minn., was on May 9, 1891, when after several days of cold the temperature rose suddenly some 20° above normal. Yet in another year the largest number of arrivals was on May 7, the last of three days of increasing cold, when the temperature was fully 20° below normal.

Evidently it is impossible to foretell what bird movements will accompany any given set of weather conditions. It may seem that a certain storm has held back the travelers, but another year, under apparently identical conditions, the birds may continue northward in spite of a storm. Birds fail to arrive when circumstances seem propitious and again come in myriads when conditions seem adverse.

EXPLANATION OF MIGRATION UNDER APPARENTLY UNFAVORABLE CONDITIONS.

The probable explanation of these wide departures from the intimate connection that has been supposed to exist between bird migra-

tion and the weather is found in the fact that migration does not progress uniformly, but is a series of advances interspersed with periods of rest or inactivity. The average daily advance of migration northward in spring in the Mississippi Valley is only 23 miles, or scarcely more than a half hour's flight; but since there are many stop-over nights on the migration journey, it follows that on each night of flight a correspondingly greater distance must be covered. Probably few night migrants make less than 100 miles at a flight, while spurts of 200 miles or more must be very common. The records of migration near the Mississippi River during one spring indicate that the purple martin made nearly the whole trip from southern Louisiana to southern Manitoba in 12 nights (120 miles a night), although 70 days were spent between the two places. A study of the weather map and of the records of the migration observers makes it probable that the fox sparrow, brown creeper, ruby-crowned kinglet, yellow-bellied woodpecker, field sparrow, and purple martin, which were noted at Lanesboro, Minn., the morning of April 1, 1888, had traveled the night before from at least as far south as Davenport and probably from Keokuk, Iowa.

It must frequently happen that migrating birds pass from auspicious into adverse weather or are caught by sudden storms and forced to alight. Next day, when they are noted as arrivals, they are recorded as having migrated during unfavorable weather, such records going to swell the percentage of exceptions to the supposed rule that birds prefer good weather for migrating.

During spring migration it is probable that birds do not start in the evening except under favorable conditions, and when these conditions hold throughout the night the flight northward is greatly prolonged. This probably explains a hitherto unnoted fact brought to light by a study of the migration data in the Biological Survey. After the northward movement has been checked and then resumed, the birds do not stop when they have made up for lost time, but keep on until they are in advance of their normal position. Several striking examples of this appear in the Lanesboro notes—in fact, examples are numerous enough to warrant the assertion that in every great migratory movement there are numerous individual birds which are ahead of their normal time.

MIGRATION AND TEMPERATURE.

On the night of March 13–14, 1904, an innumerable host of Lapland longspurs, migrating northward in southern Minnesota, encountered a heavy fall of soft, damp snow. Weighted by the clinging flakes, the birds dropped to earth, and a large proportion perished. The death toll on the hard, icy surface of two small lakes was

estimated at 750,000, while the number of lifeless bodies scattered over the 1,500 square miles of territory covered by the disaster was beyond computation. Such tragedies are fortunately rare, and yet so fickle is the spring weather that early migrants, to be successful, require constitutions hardy enough to withstand wide variations in temperature.

There is no definite temperature to which a bird is confined during migration. The insistent crescendo call of the ovenbird is associated in our minds with the full verdure of May woods, and yet the bird has been known to arrive in a snowstorm. While it prefers a temperature of about 55° F., the thermometer at the time of its appearance in southern Minnesota varies from near freezing to full summer warmth. Computations of the temperature at the time of arrival of several other common species (so well known and conspicuous that they could hardly fail to be seen as soon as they reached the home of the observer) show variations of from 14° to 37°, the average variation being 24°. During March, April, and May, in the Mississippi Valley, the thermometer rises about 1° for each two days, so that a difference of 24° would be equivalent to about 48 days' variation in the time of migration.

The later migrants are able to adapt themselves to temperatures of from 70° to 40° F., while the early ones ordinarily experience variations of from 45° to 15°, and are able to endure still greater cold. Thus the hoarse caw of the earliest crows is heard in southern Minnesota at an average temperature of 12° below freezing, and the birds can survive a sudden drop of as many degrees below zero.

MIGRATION GOVERNED BY AVERAGE WEATHER.

Birds do not migrate by chance. The habit of migration has been evolved through countless generations, and during this time birds' physical structure and habits have been undergoing a process of evolution to adapt them to the climatic conditions of their summer homes. In spring and early summer the climatic conditions are decidedly variable, and yet there must be some period that has on the average the best weather conditions for the bird's arrival. During the ages habits of migration have been developed under whose influence the bird so performs its migratory movements that on the average it arrives at the nesting site at the proper time.

The word "average" needs to be emphasized. It is the average weather at a given locality that determines the average time of the bird's arrival, and the average subsequent weather is the governing factor in deciding when the nest shall be constructed and the eggs laid. In obedience to physiologic promptings, the bird migrates at the usual average time and proceeds northward at the usual average speed unless prevented by adverse weather. But, unfortunately for

birds, these average weather conditions are interspersed with occasional drops of temperature that reduce insect-eating birds to the verge of starvation. The purple martin, being an early migrant, is peculiarly liable to such accidents. A storm in late June, 1903, in southern New Hampshire swept the air of the bird's insect prey for so long that all the young birds starved in their nesting boxes and a large proportion of the old birds perished. Conversely, birds go south in fall until they reach a district where usually they can obtain sufficient food throughout winter. But sometimes they do not go far enough to be out of reach of an exceptional blizzard. The coast of South Carolina was visited in February, 1899, by a heavy snowstorm, with the severest cold known there in two hundred years. Thousands of fox sparrows, snowbirds, and woodcock starved, and probably nine-tenths of the bluebirds and pine warblers shared their miserable fate.

The soundness in general of the birds' instincts is vindicated by the fact that all these catastrophes, appalling though they are, do not permanently diminish the bird population. Provided bad weather has not permanently reduced the food supply, the birds eventually regain their former numbers.

Take the striking case of the bluebird. The winter of 1894–95 killed off so many of the bluebirds east of the Mississippi River that in the spring of 1895 not a bluebird warble was heard in many a town where the year before there had been a full chorus. Since then their numbers have gradually increased, until now, were it not for persecution by the English sparrow, the ever-welcome bluebirds would be as numerous as ever.

BIRDS PREFER MIGRATING IN WARM WEATHER.

It is well known that migration is retarded by severe cold weather and is accelerated by unusually warm weather. The 10 years of observations at Lanesboro—the most accurate record that has ever been made in the United States—show about 50 per cent more arrivals during the warmer than during the colder days. The number of birds that migrate during periods of low temperature is, however, surprisingly large, and it might be objected that many of the birds recorded during cold days really came unnoticed during a previous warm spell, but the chances are that the errors of omission would count most heavily in the opposite direction, since shivering birds are apt to sink into silence and seclusion, while on warm days both melody and motion betray their presence.

A rise in temperature is interpreted by the birds as a signal for migrating. At the end of a cold snap that has halted the advance, the birds do not wait until the mercury rises to normal, but start north as soon as there is a marked change for the better. The Lanes-

boro records show just twice as many instances of arrival during a rising as during a falling temperature; and the average temperature of the two days before a bird arrives, when calculated for a series of years, is always less than the average temperature of the day of arrival.

Every student of bird migration has noticed that in an unusually early spring the first migrants arrive ahead of their average dates. Thus in Washington during March and April, 1910, almost every species anticipated its usual date of arrival. But it is seldom, if ever, that such untimeliness continues throughout an entire season, nor is any entire season likely to be later than usual. Indeed, seasons are such combinations of warm and cold waves that the average date of arrival for the whole migration period is remarkably uniform. At Lanesboro the average date of arrival for all species is April 25; the extremes vary less than four days, and the average variation from year to year is only a single day.

It has already been stated that each species prefers to arrive at its breeding grounds when the average temperature is within certain definite limits. Thus the Baltimore oriole arrives in southern Minnesota when the thermometer ranges around 55° F., but it does not follow that the oriole will appear in spring as soon as the temperature rises to that degree, nor that the bird never arrives before the temperature reaches that point. One spring at Lanesboro the 10 days from April 13 to 23 averaged 10° warmer than the oriole's preferred temperature, but no orioles appeared until May. Another year the Baltimore oriole appeared at Lanesboro when for two weeks the thermometer had not risen above 48° F. The point to be emphasized is that a knowledge of weather conditions in any given season is not a basis for deducing the time of arrival that season of any particular species.

BIRDS CAN NOT FORETELL WEATHER CHANGES.

One morning in October the base of the Statue of Liberty in New York Harbor was covered with the dead bodies of birds that had struck against the light during the previous night. More than 175 were picked up, and a larger number had fallen into the sea, all victims of this one light during a single night. Similar destruction occurs during each storm of the migration season. Whirled by the tempest until they lose all sense of direction, with the landmarks hidden by enveloping clouds, the birds are lured to death by a beacon light penetrating the mist. A continuous red light or a flashing intermittent light of any color does not attract them, but a steady white light is irresistible.

Nor are man's beacons the only agents destructive to migrating hosts. The night of October 10, 1906, flocks of migrants over Lake Huron were caught by a snowstorm and forced into the waves, and

according to an observer on the eastern shore 5,000 dead birds to the mile were strewn along the sands—only a part of those that perished.

The frequency of these disasters proves that birds can not foretell the weather. No bird starts on a migratory flight during a rain or in a dense fog or against a chilling blast, and yet thousands of birds each year are found near lighthouses and along the shores of large bodies of water under just such weather conditions, showing that after starting they met or were overtaken by the storm. The early settlers in the Mississippi Valley noticed so often that an exceptionally heavy flight of ducks and geese moving straight south at a high altitude was soon followed by a severe storm that they came to have great faith in the birds as weather prophets and believed that they could actually foretell an approaching tempest. It is more probable that the birds began to migrate at the first signs of the storm and outstripped it in their southward flight.

BEGINNINGS OF MIGRATION.

It may be safely stated that the weather in the winter home has nothing to do with starting birds on the spring migration, except in the case of a few, like ducks and geese, that press northward as fast as open water appears. There is no appreciable change in temperature to warn the hundred or more species of our birds which visit South America in winter that it is time to migrate. It must be a force from within that makes them spread their wings for the long flight. The most important duty of the individual bird is the perpetuation of the species, and the impulse which annually starts the bird north toward its breeding grounds is physiological.

UNIFORMITY OF ARRIVAL.

Were the surface of the earth level and the climate absolutely uniform, birds would arrive at a given place on approximately the same day each year, but the records for a series of years at any given locality show considerable variation in the dates of arrival. Part of this variation is undoubtedly due to errors of observation, for series of notes on the same species by different observers in neighboring localities often show highly improbable differences in the apparent regularity of arrival. In the records of the Biological Survey the best example of uniformity in arrival is that of the chimney swift at New Market, Va., as noted by George M. Neese. The dates of each year from 1884 to 1906 are, respectively: April 16, 16, 15, 16, 16, 11, 9, 15, 21, 14, 15, 14, 12, 7, 16, 14, 16, 12, 11, 9, 12, 12, 10. The three days, April 14, 15, and 16, include more than half the years, the average date is April 13, and the average variation from this date is only 2.2 days. Usually, however, the recorded dates of arrival of a species vary irregularly from 10 to 14 days, with an average variation of a little more than 3 days. These variations and

the date of arrival on its nesting grounds depend on the combination of storm and fair weather met during the journey.

The arrival of a migrating bird in any district south of its final goal depends not so much on the local temperature of that district as on its geographic relation to the place of nesting. The summer warblers, for instance, which nest in Manitoba, doubtless spend the winter in South America and probably start north in March, arriving in Manitoba the middle of May, where they find an average temperature of about 48° F. As this is the time they begin summer housekeeping, it is evident that these warblers obtain an abundance of food at this temperature. Leaving South America with the thermometer higher than 70° F., throughout the entire trip they are in a temperature warmer than is required for their food supply, and it is only during severe storms or unusual cold that climatic conditions delay their northward progress.

Thus over the whole flight way between the winter and summer homes, local weather conditions have little influence on the average time of the bird's arrival, except when it nears its breeding grounds. Then it approaches a critical zone, where its migration is very likely to be affected by the weather. The summer warbler usually finds in Louisiana a temperature of 70° F., and a drop of 10° would hardly retard its progress; but if, just before it reached Manitoba, the temperature should fall from 48° F. to 38° F., it would probably fold its wings and wait.

FALL MIGRATION.

The data available for the study of fall migration are much less in quantity, as well as less reliable, than those on spring migration. It may be said, however, that almost without exception the beginnings of fall migration have no relation whatever to the weather. Most species migrate as soon as the young are able to care for themselves; others begin molting then and start on their southward trip when their new fall suits are ready. Many species begin to go south in July and most of the others early in August, long before the fall storms have lessened their food supply, and, indeed, at the time when food is most plentiful.

After the tide of fall migration is in full swing, its advance is varied by alternating storms and fair weather, as in spring, but with exactly opposite effects; instead of delaying migration, a fall storm causes the departing hosts to hasten their movements before the chilling northern blasts. In spring the larger part of migration occurs with a rising temperature; in fall a still larger percentage occurs when the temperature is falling.

MIGRATION AND WIND.

During spring migration the direction of the wind seems to have little if any effect on the movements of birds. Arrivals were noted

at Lanesboro, Minn., 102 days when the wind was south, southeast, or southwest, as against 96 days when the wind was north, northeast, or northwest. Thus the birds migrated with the wind against them just about as frequently as with the wind in their favor. Observations at the lighthouses of southern Florida point to the same conclusion. The Biological Survey has the records for many years of each night in spring on which birds were noted passing the lights. These migrants had just reached Florida by a flight over the ocean from Cuba. One might expect them to wait for a favoring wind before starting to sea, but the records indicate that they paid no attention to the direction of the wind.

In fall it seems to be different, but it must be remembered that most that has been published on the interrelation of bird flights and the wind in fall refers to the late migrants, which have waited until they are forced south by the advance of winter. The larger part of fall migration occurs in late summer and early autumn, before the equinoctial storms set in and the temperature drops. There is no reason for believing that the movements of birds at this time have any more intimate relation to the direction of the wind than in spring. It is true that late migrants hurry southward with a north storm and halt on the advent of a south wind, but the real cause of the southward journey is probably the cold that accompanies the north wind.

EQUAL FLIGHT LINES.

Another question arises: Do the individuals of a given species migrate along the Atlantic slope at the same time and at the same average temperature as those in the Mississippi Valley or on the Pacific coast? Few species extend their range from ocean to ocean and are also so common and well known that sufficient data concerning them have been accumulated to permit definite deductions. But a study of several wide-ranging species makes it certain that each one is a law unto itself, and that it is not safe to reason from one species to another, even if closely related. Thus the purple martin and the cliff swallow both desert the United States during winter to sojourn in South America; both return to the United States in spring and breed from the Atlantic to the Pacific; but while the purple martin keeps approximately the same temperature in its advance along the coast and the interior, the cliff swallow moves up the Mississippi Valley at a much lower temperature than along the Atlantic coast, and, indeed, orders its movements with less relation to the progress of the season than any other bird so far studied.

The summer warbler is so abundant and well known that voluminous records of its migrations are on file in the Biological Survey. It observes a very regular spring schedule, as is shown by the accom-

panying map (fig. 30)—the first of the kind ever published in this country—giving the spring advance of the season, as shown by isotherms, in comparison with the corresponding equal flight lines or isochronal lines of the summer warbler. This bird was selected because it winters entirely south of the United States and during migration occurs from ocean to ocean and from the Gulf of Mexico to Canada. By April 10 the warbler is noted across the whole country from South Carolina to California. At this date the foremost rank of birds—the equal flight line of April 10—is closely coincident with the isotherm of 62° at the Mississippi River, slightly in advance in South Carolina and Arizona, and still farther north on the Pacific slope. These differences in the West constantly increase as the season advances.

During the 10 days from April 10 to April 20 the isochronal line of the summer warbler moves to Virginia, southern Illinois, and northern California, which brings it on April 20 approximately along the isotherm of 58°. The birds have moved north faster than the season. During the whole trip from the Gulf of Mexico to Canada, for each 10 days of the spring flight there is a remarkably uniform drop of 4° in the average temperature at which the van of migration is moving, and while the earliest migrants reach the United States when the daily mean temperature is about 60° F., those which nest in northern Canada reach their northern summer home when the daily mean temperature is below 45° F.

On April 30 the earliest summer warblers have reached northeastern Nebraska, while to the westward the van is 350 miles in the rear and is just appearing in southeastern Colorado. This retardation of migration is due to the increasing elevation of the land from the Missouri westward, which causes a decrease of temperature. On the great western plains, where the slope is about 6 feet to the mile, bird migration is retarded on the average one day for each 300 feet increase in altitude. For steeper slopes there is still greater retardation of migration relatively to the increase in altitude.

On the Pacific coast, from April 10 to 20, the summer warblers advance about as fast as the spring, but within the next 10 days they appear in southwestern British Columbia, having averaged 75 miles a day—two and one-half times the speed of those on the Atlantic slope; also in these 10 days they have gone from a temperature of 58° F. to one of 48° F., while the eastern birds were dropping from 58° F. only to 54° F.

The map shows also some interesting facts as to the route of the migration flight. All the numerous records of the summer warbler's arrival in southern Texas from San Antonio to Brownsville are later than those of northeastern Texas, showing that the early migrants reach the northeastern part of that State by a direct flight over the

Gulf of Mexico, while the late birds in southern Texas probably travel by a land route through Mexico. Similarly the dates of spring arrival are earlier in northern Georgia than in southeastern Georgia and northeastern Florida, indicating that the earliest migrants across the Gulf of Mexico fly far inland before alighting.

The summer warbler arrives at Edmonton, Alberta, earlier than at central Montana, 400 miles south. Evidently the Edmonton birds do not come from the south, neither are they from the southeast, for migration is no earlier in southern Manitoba than it is in central Alberta. Hence they must come from the southwest, though this necessitates their crossing the main range of the Rocky Mountains, which at this season is still cold and partly covered with snow.

CONCLUSION.

The foregoing facts show conclusively that weather conditions are not the cause of the migration of birds, but that the weather, by influencing the food supply, is the chief factor which determines the average date of arrival at the breeding grounds. Migration is undertaken in response to physiological changes in birds, and the date of starting, in the case of most species, bears no relation whatever to the local weather conditions in the winter home. The weather encountered en route influences migration in a subordinate way, retarding or accelerating the birds' advance by only a few days and having slight relation to the date of arrival at the nesting site.

Local weather conditions on the day of arrival at any given locality are minor factors in determining the appearance of a species at that place and time. The major factors in the problem are the weather conditions far to the southward, where the night's flight began, and the relation which that place and time bear to the average position of the bird under normal weather conditions. Many, if not most, instances of arrivals of birds under adverse weather conditions are probably explainable by the supposition that the flight was begun under favorable auspices and that late in the night the weather changed. Spring migration usually occurs with a rising temperature and the movements of autumn with a falling temperature. In each case the change seems to be a more potent factor than the absolute degree of cold.

The direction and force of the wind—except as they are occasionally intimately connected with sudden and extreme variations in temperature—seem to have only a slight influence on migration.

Another conclusion equally apparent is that neither the time of migration, the route, nor the speed of one species can be deduced from records of other species, even though closely related; in other words, each species and even each group of individuals of a species is a law unto itself.

COOPERATION IN THE HANDLING AND MARKETING OF FRUIT.

By G. Harold Powell,

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INTRODUCTION.

The handling and marketing of crops through cooperative associations is more highly developed in fruit growing than in any other agricultural industry in America. These organizations are formed to purchase the supplies used in the production and marketing of the crops, to standardize the harvesting, handling, grading, and packing of the fruit, to sell the fruit of the members as a unit under whatever system of marketing is adopted, to prevent disastrous competition by bringing about an equitable distribution throughout the country, and to handle the fruit business in other ways collectively rather than individually whenever it can be done more economically and effectively. There are several hundred of these associations among the fruit growers of the Western States and a number that are successful among the fruit growers in the central West and along the Atlantic coast.

COOPERATION IN THE WEST.

Fruit growing is a highly specialized industry in the Western States. The growers there have often had extensive business experience before engaging in horticulture. The industry in the West is confined to the valleys and foothills or is more or less geographically localized in other ways. Land values are usually high in comparison with the price of land in the East, cultural practices are more expensive and intensive, the markets are thousands of miles distant, and the problems of production, transportation, distribution, marketing, and legislation are too complex for the average individual grower to meet and solve alone. Under these conditions cooperative effort is a business necessity, just as the consolidation of capital in other industries is necessary for its own preservation. The production, buying, distribution, and selling of crops must be accomplished by working together. Things must be done in a large way if the fruit grower is to deal on the same level with the combinations of

capital with which his product comes in contact at every step from the orchard to the consumer. The western fruit growers have therefore formed associations of various kinds to work out the problems that confront them.

At the foundation of the semiarid western horticulture lies the necessity for irrigation, and the irrigation systems, which are largely owned and controlled by the farmers, form a common tie which binds them closely together and makes cooperation in other things more easily accomplished than is the case in the humid fruit-growing sections of the East. They may cooperate to protect the orchards from insect pests and diseases or from frost, to pick the fruit, to prepare it for shipment, and to direct its distribution, storage, and marketing. They may own outfits for spraying and fumigating, packing houses that cost thousands of dollars, and storage plants of large capacity. They may develop a system of distribution and of market reporting which keeps them in daily touch with the markets in every part of the United States and Canada and with the general movement of fruit in transit. They may advertise their products extensively and through their organizations handle the legislative and other public-policy questions that vitally affect the industry.

COOPERATION IN THE EAST.

In the central and eastern parts of the country the growing of fruit is not usually specialized or localized. It is more likely to be an incidental feature of the general agriculture of a community. It is slowly developing into a specialized industry, especially in many sections of the East and South, though it is still largely in the hands of men whose only experience has been gained on the farm. In the eastern half of the United States, where irrigation is not required, the difficulties of production are more easily overcome, competition among fruit buyers is more or less keen, markets are comparatively close at hand, and the problems of transportation and of marketing are not as acute as they are with the western fruit grower.

The need of cooperation has not faced the eastern fruit grower as squarely as it has the grower in the West. Hence, the cooperative movement has been of slower development in the East, except in such industries as grape growing in western New York and the citrus-fruit industry in Florida, where the stability of the capital invested has been threatened as a result of a haphazard system of individual distribution or of local selling and marketing. Under these conditions there have been formed virile organizations of growers for the distribution and marketing of the products, and such organizations when properly directed have been successful.

THE INDIVIDUALISM OF THE FARMER.

Cooperation among farmers is more difficult to effect than the consolidation of capital in other business enterprises. The farmer is the most individualistic of American citizens. It is not easy for him to transact his business with his neighbors. Independence in handling his affairs is a tradition that has been his for generations. He would rather conduct his business man to man, as his fathers have done before him, unless necessity compels him to do otherwise. The cooperative movements that have been organized among prosperous fruit growers have usually failed. The social, the political, or the altruistic motives have not been strong enough to hold a group of money-making farmers together. The only successful cooperative efforts until recently have been those which have been born of desperate necessity.

Cooperation must be effected when the fruit industry is at low ebb to have the virility to live in the face of the attacks to which all such efforts are at first subjected, but after the growers have learned the power of cooperation as a business opportunity, their organizations become permanent and exert a powerful influence in the development of a better social life and, through their participation in the progress and management of rural affairs, in the development of a better citizenship. No other agency is so powerful in bringing about better farming, better methods of handling the industry, a greater prosperity, and a better community than a group of farmers who are successfully organized to protect and develop their agricultural interests. The American farmer is beginning to realize that the powerful influence of consolidated capital has been the source of the tremendous industrial progress of the last generation. He is beginning to take a greater interest in the possibilities of cooperative action when applied to his own problems.

FUNDAMENTAL PRINCIPLES OF COOPERATION.

There are many kinds of cooperative associations among the fruit growers of the United States. In a nonprofit association, which represents the ideal type of cooperation, the members usually have an equal voice in its management and share proportionately in its benefits and risks. Such an organization is a voluntary industrial democracy in which the fruit growers manage and control the distribution and marketing of their own products. Every member of the association is a bona fide producer and his fruit is handled exclusively by the association. All of the operations are carried on at cost, and after operating expenses, depreciation, and a reasonable interest on the capital invested in the equipment of the association are deducted, the profits are distributed to the members in

proportion to the amount of business each has transacted through the organization. The powers of the association are vested in a board of directors selected by the growers, who manage and control its affairs and business through officers or agents appointed by it and subject to its advice and direction.

THE ORGANIZATION OF A COOPERATIVE ASSOCIATION.

The first step in organizing a cooperative association is to incorporate it under the laws of a State. This usually has to be done under the laws that authorize the formation of stock or membership corporations, as few of the States have provided for the incorporation of nonprofit cooperative agricultural or horticultural associations.

The association needs to be incorporated on broad lines. The articles of incorporation should set forth the purpose for which the association is formed and should provide for every activity in which it may wish to engage. They should define the principal place of business, the life of the association, the number and power of the directors, the voting power and property rights of the members, the amount of the capital stock, and all other things of a general nature that are needed to be included in the incorporation of such a body.

A code of by-laws needs to be adopted for the government and management of a cooperative association. The by-laws should define the method of exercising the power of the corporation through the board of directors and the officers appointed by it, the conditions surrounding the admission of members, the dues or stock to be paid by each, and the conditions surrounding the same. They should provide broad powers for the manager, including the supervision of the harvesting, grading, packing, distribution, and sale of the fruit, or for such of these operations as the association may wish to perform. They should define the grades to be adopted by the association for each kind of fruit. They should contain a provision by which the grower gives the association the exclusive right to market the fruit, with the possible exception of the lowest grades, and to harvest, grade, and pack the same. This includes the selling of the fruit for the members either as individuals or through pools of fruit, a penalty to be collected by the association for every package sold outside of the association. These objects are attained by the signature of the farmer to the by-laws of the association, or the association may require a special contract to be executed with the cooperating member.

The methods of providing money for operating expenses, such as a fixed assessment against every package of fruit handled by the association, and the method of prorating the balance if the total amount of the package assessment amounts to more than the operating expenses, and other things usually included in such organizations should be set forth in the by-laws.

TYPES OF COOPERATIVE ASSOCIATIONS.

The fruit growers' organizations vary in form from joint-stock companies composed of growers or dealers or of both, who distribute their own products or the products of others to the simple nonprofit form of cooperative association which purchases the supplies and distributes the products of its members at cost. The voting power of the members in the different associations varies from a single vote for each member to a vote proportional to the amount of stock owned by each or to the acreage held by each. His voting power may depend on the probable crop production or the actual production of the preceding year. The capital may be contributed in limited amount equally by each member in proportion to the acreage held by each or to the probable production of each member, or unequally without reference to either of these factors. It may be contributed by business men who are not fruit growers, but who desire to encourage the formation of associations; or the capital stock may be subscribed as an investment, and a high rate of interest paid on it before the profits are distributed to the growers. Some of the associations handle fruit on speculation or for nonmembers at a specified rate per package.

All of these types of so-called cooperative associations and many others are in operation with a greater or less degree of success. The most virile and effective from the standpoint of the producer are those which are strictly cooperative, nonprofit in type, each member contributing an equal amount of capital and having an equal voice in its management or a voting power and capital contribution in proportion to the acreage of bearing fruit held by each. The association handles the fruit of the members only, and the fruit is under the control of the association from the tree to the market. The objection urged against this form of organization is that the small grower has an equal voice with the large grower in fixing the policies of the associations. The objection to the voting power based on acreage is that the exceptional grower has no more influence than a poor grower of equal acreage. There is equally strong objection to the form of power based on production, as the pro rata of production may vary with the seasons. All of these objections are discussed in the following pages.

CAUSES OF FAILURE IN COOPERATIVE ASSOCIATIONS.

Not all of the cooperative associations are successful. In fact, comparatively few of them have been distinctly successful, especially among the early associations formed before the citrus-fruit growers of California organized to distribute their products and to protect the capital invested in their industry. The citrus-fruit organizations, most of which are founded on the true cooperative, nonprofit

basis, have had a far-reaching influence on the cooperative movement in the United States.

The orange and lemon growers of California have the most powerful and successful organizations to be found in any agricultural industry in the United States, if not in the world, one organization acting as an agent in distributing $15,000,000 worth of fruit a year for its 6,000 members, organized into more than a hundred associations on a nonprofit basis. This agency sends fruit to every part of the United States and Canada and to several foreign countries, maintaining its own exclusive representatives in all of the principal markets of America. Many of the cooperative associations organized in recent years have been formed on the principles that underlie the citrus-fruit associations, and these, when wisely managed, have shown great strength.

THE MANAGEMENT OF A COOPERATIVE ASSOCIATION.

Several factors have contributed to the downfall of fruit-growers' associations. Many of them have been formed by impractical, often unsuccessful enthusiasts with high motives, but with no business experience and little standing in their communities. Others have been formed ahead of their time when the industry was too successful for the members to be held together. Many of them have been managed by incompetent, low-salaried men, not infrequently by those who have been unsuccessful in business. The successful handling of a cooperative association requires a manager who is competent to assume the general direction of the affairs and business of the association. He must have a high order of business ability, sterling integrity, unusual tact and judgment in handling men, and unlimited energy. An association under any other kind of management is not a serious business undertaking.

It is more difficult to direct a cooperative association than a stock company or corporation. In the latter the manager is responsible to a board of directors, but the stockholders do not often take an active interest in the management of its affairs. In the cooperative association the manager is also subject to the advice and control of the board of directors, but the farmer who joins with his neighbors in an association is likely to take more than a passing interest in the management of the association. A manager who can not hold the interest and the confidence of the members, who can not make them feel that they have a voice in the management, and who fails to develop a progressive, constructive business policy will fail in handling a cooperative organization. Nor can such an organization succeed if the directors do not realize that it must have a strong, competent, aggressive, well-paid manager at its head. It is not too much to say that no single factor has operated against the success of the cooper-

ative associations as much as the incompetent managers selected by the directors of the associations to handle them. A board of directors can not manage a cooperative agricultural association. The outcome of the organization will be determined in large degree by the character and ability of the manager.

THE PAYMENT OF DIVIDENDS.

Another factor that has operated against the success of many so-called cooperative associations has been the payment of high dividends on the capital invested, the stock having been subscribed unequally by a comparatively few members. The organization in which the business is not transacted at cost can not hold the confidence and support of its members. The payment of one or two high dividends on the capital stock before the proceeds are distributed to the growers has caused the downfall of many associations that have been well organized in other respects. Another dangerous element has been the ambitious effort of new associations to buy and sell fruit and supplies outside of the membership. The speculative element must be rigidly excluded from cooperative associations. The harvesting, grading, packing, and handling of fruit not grown by members invariably leads to a lowering of the established standards of grading and packing and to injury to the reputation and financial standing of the association.

DISLOYALTY OF MEMBERS A CAUSE OF FAILURE.

Many cooperative efforts fail through the disloyalty of members when the association is subjected to the skillful, insidious fire of those who oppose it. The farmer is not used to having his business attacked, and those who are interested in disrupting the organization appeal directly to his pocketbook by attempting to show that the association does not realize as much for the fruit as the farmer could realize outside the association. They also persistently insinuate that the association is grossly mismanaged.

It is a favorite practice of the opponents of cooperative distribution and selling to offer association members a premium on their fruits. The apple grower is tempted by a premium of 25 to 50 cents a barrel over the probable return of the association; the peach grower by an advance of 10 to 20 cents a box or basket, and the pear or small-fruit grower by an equally attractive bonus. The man with a small crop and a still smaller capital often falls before this kind of temptation, and if it is held out long enough the association may be disrupted. These devices are coming to be well understood and the fruit grower who joins an association in good faith and sells out for a small premium is in danger of losing the respect and confidence of his neighbors.

THE MEMBERSHIP CONTRACT.

It is a fundamental necessity that the members be held together by a contract or a provision in the by-laws which gives the association the exclusive right to pick, pack, haul, grade, mark, and sell the fruit of its members, or to perform as many of these operations as it may decide to perform, or to supervise or regulate these operations under rules made by the association. The contract should be drawn for a term of three to five years, giving the grower the privilege of withdrawing by notice at the end of any fruit year, thereby making his continued connection with the association voluntary. The contract should specify a penalty to be assessed against every package of fruit sold outside of the association, this penalty to equal not less than 25 per cent of the value of the fruit. Under any other plan an association can not build on a solid foundation. It can not foresee the probable volume of business to be transacted, nor can it provide the means to purchase the supplies for handling the crop or reach that degree of stability that is essential to the success of a business undertaking. The membership contract with the grower is the foundation stone on which the business of the association is reared and without which its existence and stability are problematical.

COOPERATION IN THE PURCHASE OF SUPPLIES.

In every cooperative association there should be a division for the purchase, sale, or manufacture of supplies of every kind used in the production, packing, handling, shipping, and marketing of the crop. The association should be prepared to purchase fertilizers, materials, and equipment for spraying and fumigation; the facilities used in frost protection, pruning, or harvesting; orchard machinery; or any other equipment on which a saving can be made by cooperative purchase. It should be prepared to purchase the supplies for fruit handling and marketing, such as box shooks or packages, picking boxes, nails, wrapping paper, and all kinds of packing-house equipment.

The money needed to operate this purchasing division may be raised by assessment, by the individual notes of the directors of the association, or in other ways. The association should sell the supplies to the members at a fair market price, and at the end of the season should prorate the surplus to the members or invest it in the business, after deducting the operating charges, depreciation, and other necessary expenses, including interest on the assets and capital devoted to this supply division.

COOPERATION IN THE HANDLING OF FRUIT.

The condition in which fruit reaches the consumer depends largely on the care with which it is handled. The most common rots of apples and pears, of small fruits, and of citrus fruits are directly related to the mechanical bruising of the fruit, most of the diseases not having the power of penetrating a healthy, uninjured skin. The association must therefore provide rigid rules for picking. It must either supervise the harvesting, grading, and packing of the fruit and provide for the most rigid inspection of every lot before it is accepted by the association for shipment, or else the harvesting, grading, and packing must be done by the association. In most of the associations where the fruit is not packed in central packing houses, it is picked and packed by the grower according to the rules of the association, and inspected by an employee of the association before it is accepted for shipment.

This system works fairly well with the small fruits and the deciduous summer fruits, which have to be handled quickly from the field to the consumer. It is not a satisfactory system to apply to the citrus fruits or to the apple or pear crops. With these the handling, grading, and packing must be standardized, and this can be done only when the association controls all of the handling operations or actually performs them. Many apple associations establish rules of grading and packing. The association grower picks and packs the fruit, and the association accepts or rejects it by inspecting the packages when delivered at the railroad station, the association warehouse, or some other point. But experience has shown that the grower can rarely be depended on to pick and pack the fruit in the best manner. It requires skilled labor, and fruit grading and packing is an art that is acquired by few individual fruit growers. An association, therefore, that operates on this principle seldom reaches the highest degree of success, and is likely to fail outright.

A better plan is to have the grower pick the fruit when directed to do so by the association. It is then graded and packed according to the rules of the association in the orchard or in the fruit house on the farm by trained men in the employ of the association. Under this plan the grading and packing of the fruit of the entire membership can be done with comparative uniformity. Even then the packages need to be inspected before they are accepted by the association. Every package rejected should be regraded and repacked or placed in a low grade. This system is in operation in several of the most successful cooperative apple-growers' associations in the United States.

Another plan is to grade and pack the fruit at a central packing house owned and controlled by the association. The growers pick the

fruit, haul it to the packing house, and there it is graded and packed by the association. This is the plan that was formerly in general operation in the orange and lemon growing districts and is followed to a limited extent at the present time. The objection to this plan is that no two growers handle the fruit with equal care, and the different lots of fruit therefore vary in physical condition and in susceptibility to decay. Under this system there is a wide variation in the percentage of decay that develops in the fruit of different members while in transit to market. If the fruit is pooled, the grower who handles his fruit carefully has to share the losses that develop in the fruit that has been carelessly handled.

The most satisfactory plan in the citrus-fruit industry (and this may be applied to some other fruits) is to have the association train gangs of laborers who shall pick the fruit of all of the members. The laborers should be paid by the day, as contract or piecework places a premium on rapid, careless work. In this way the picking can be standardized, the quantity of fruit that passes through the packing house can be controlled, and the grading and packing can be uniformly done.

This system has been generally adopted in the citrus-fruit industry as a result of the investigations of the Department of Agriculture into the causes of decay in oranges and lemons while in transit from California to the East. This investigation showed that the decay was the result of the improper handling of the fruit in preparing it for shipment, and that it could be controlled by placing the handling of the fruit entirely in the hands of the associations. The same laborers often fumigate the orchards of the members for scale insects and spray the trees wherever spraying is practiced.

THE CENTRAL PACKING HOUSE.

The tendency in the cooperative movement is toward a central packing house where the fruit of the members is brought together and is graded and packed for shipment. In the small-fruit industry this plan is hardly practicable. It is sometimes successfully operated in the deciduous-fruit and in the grape industries. There are about 200 of these association packing houses in the citrus industry in California, and the Florida citrus growers are rapidly organizing along these lines. A packing house is erected by the association, usually alongside the railroad, and is equipped with the necessary appliances for fruit handling and packing, the manager of the packing house being usually the general manager of the association. Precooling and cold-storage plants, box-nailing and labeling machinery, and other devices required in the industry are to be found in many of the association houses.

THE POOLING OF FRUIT.

There is a growing practice in the cooperative associations to pool and sell the fruit as a common commodity under the brands of the association rather than to sell the fruit of each grower separately. The pool is an arrangement by which the similar grades of fruit of all of the growers are united and sold together. At the end of a pool, which may vary from a daily pool in the summer-fruit business to a monthly or semimonthly pool in the citrus-fruit business or a season pool in the apple industry, the grower receives his pro rata of the proceeds based on the number of pounds or packages of each grade that he has contributed. In theory the grower has the privilege of contributing to each pool his pro rata of the fruit of the association as a whole, the manager of the association usually apportioning to the growers their quota in accordance with their respective acreage. The pooling arrangement greatly simplifies the practical business methods of an association.

The successful working of the pooling system depends on having the handling, grading, and packing of the fruit under the direction or control of the association. It may but does not often succeed where these operations are in the hands of the grower. It depends, further, on having a large proportion of the fruit of the association of uniform grade. There is considerable variation in the average quality of different lots of fruit in the same grade, even under the most rigid system of grading. The fancy grade of one grower may average better than the fancy of another, though the fruit of both is entitled to be graded fancy under the established rules of the association.

No grower is willing to admit that he does not raise the best fruit in his community, and where it happens that his fruit falls below the average and he is paid for a larger proportion of the lower grades than his neighbor he may become dissatisfied, when he will either drift along and finally leave the association or will adopt better cultural methods. In some communities there is a friendly rivalry among the association members in securing the largest proportion of the higher grades of fruit. The grade of fruit grown under similar conditions of soil and location depends largely on the cultural skill of the grower, and the publicity that the association affords regarding the results of grading the fruit of different growers is a strong factor in stimulating better cultural methods in a community as a whole.

On the other hand, the pooling system may not encourage the unusually skillful grower to develop fruit of the highest average grade. If he stands alone as a skillful grower, he will not get the full

advantage of his extra-fine fruit in the pool, as the practical effect of the pool is to lower the average price of extra-fine fruit and to raise the price of fruit that can barely enter a grade. An association ought, therefore, to be composed of members located similarly as to soil and other physical conditions and having similar cultural skill and, preferably, similar acreage. Unless these fundamental conditions are carefully guarded, the pooling system may tend to lower the average grade of the fruit of a community because the grower, realizing that the identity of his fruit is lost in the pool, may grow careless in his cultural practices and trust to the better fruit of his more careful neighbors to raise the average net returns of the grades in which his fruit is pooled.

THE SIZE OF A COOPERATIVE ASSOCIATION.

In theory a large association can handle a business more economically than a small one. It is not usually practicable in the orange business, for example, to organize an association and build a packing house unless there are at least 150 cars of fruit to ship. The largest associations do not often ship more than 750 cars, and only a few of these large associations are highly successful, as they are likely to become unwieldy and difficult to hold together.

There is a wide difference in the character of the fruit grown on different soils at different altitudes or with other dissimilar physical conditions. The variation shows in the texture of the skin, in its color and clearness, in the flavor of the fruit, and in those qualities which give it style and attractiveness. There is no system of grading by which the fruit grown under different conditions can be made uniform and similar. An association should therefore include not only those growers who are similarly skillful, but also those whose fruit naturally shows similar characteristics.

In a community in which the fruit is somewhat variable it is a wiser policy to organize several associations, each with its brands of fruit, than to attempt to market all of the fruit under the same brand through one organization. These organizations may act independently in the purchase of supplies and in the marketing of the fruit, or they may federate and form an agency to act for them in the distribution and marketing of the fruit, in the purchase of supplies, and in promoting the cooperative movement in other ways. It is only under this method of organization that the cooperative association can reach its highest development as a business organization and have its greatest effect in the development of better methods of fruit growing and in rural development.

THE ORGANIZATION OF THE CITRUS-FRUIT INDUSTRY OF CALIFORNIA.

The citrus-fruit industry in California, which has developed commercially since 1873, when the Washington Navel orange, originally grown in Brazil, was sent to Riverside by the United States Department of Agriculture, represents an investment of 150 to 175 million dollars. The annual shipments of oranges and lemons have reached the enormous total of 40,000 to 50,000 carloads, with a value in California estimated to vary from 20 to 30 million dollars. Between 125,000 and 150,000 acres have been planted to citrus fruits, and from 100,000 to 150,000 people depend on the industry for a livelihood.

The industry is localized largely in southern California, though it is extending rapidly in the interior valleys to the north. No other horticultural industry in the United States of equal extent is so compactly located. None presents more difficult problems or requires a more skillful distribution and marketing of the crop. Oranges and lemons are distributed from California practically every day in the year for distances of thousands of miles to all of the important cities and towns in the United States and Canada, and some are exported to other countries.

When the industry was small no complicated problems of distribution or marketing faced the grower. The fruit was sold for cash to buyers on the ground or to brokers who represented distant commission houses or other interests, or it may have been sent direct to a commission firm in some far-away city. As the industry grew larger and there were several thousand carloads of fruit to sell, the grower began to realize that the systems of selling the fruit already in operation were inadequate to bring to him the proportion of the returns which his capital was earning and to which he considered himself entitled. Under the system in operation there were frequent gluts in a few of the markets and apparently no effort among the buyers to equalize the distribution of the fruit geographically or throughout the year. The buyers were said sometimes to have fixed the maximum price which would be paid the grower and to apportion the citrus-fruit area into districts so as to reduce competition among themselves. The result was disastrous to the producer and became so serious in the early nineties as to threaten to wipe out the capital invested in the industry.

About this time the growers began to organize small associations for the purpose of preparing the fruit for shipment, and in order that it might be assembled in quantity and sold for cash or shipped as a unit. Mr. T. H. B. Chamblin, of Riverside, was the pioneer in organizing the citrus-fruit growers in southern California. The Pachappa Fruit Association was the first one formed, about 1888. A number of these growers' associations were soon formed, and in

1893 a plan was outlined by Mr. Chamblin, and finally adopted in principle, which federated a number of the associations and provided for the preparation of the fruit for market by the local associations, for the organization of district exchanges to be made up of the local associations, which were to receive orders for the fruit and apportion them among the associations, it being the intent at that time to ship only such fruit as was sold before picking, and the formation of an executive committee, made up of representatives from the district exchanges, to market the fruit.

Out of this federation grew the Southern California Fruit Exchange in 1895, and later, in 1905, the California Fruit-Growers Exchange, which now handles about 60 per cent of the citrus fruits grown in California. There are many other associations of growers not connected with the exchange which are organized on the same general principles, and these associations, together with the exchange and a few large growers who market their own fruit, handle about 85 per cent of the citrus-fruit crop.

In order that the principles which underlie the largest cooperative fruit-marketing organization in the United States may be understood, a brief outline of the exchange system follows:

The California Fruit-Growers Exchange represents about 6,000 growers who have organized themselves into 100 or more local associations. The association usually owns its own packing house, where the fruit of the members is assembled, pooled, and prepared for market under brands adopted for the different grades by the association. The association usually picks the fruit of the members.

The associations in the different regions combine into one or more district exchanges which represent the associations in the business operations common to each and which sell the fruit in cooperation with the California Fruit-Growers Exchange through the district or local agents of the latter or at auction, receiving the proceeds therefor through the California Fruit-Growers Exchange, an incorporated agency formed by a representative of each of the sixteen district exchanges, which acts as the selling agent for these district exchanges. The California Fruit-Growers Exchange takes the fruit of the district exchanges after it is packed and with their advice places it in the different markets, sells it through its own exclusive agents to the trade or by auction, and collects the proceeds and transmits them to the district exchanges, which in turn pay the growers through the local associations.

The central exchange, the district exchange, and the association all transact the business for the grower at actual cost. The central exchange through its agents is in daily touch with the markets of America, thereby enabling it to distribute its fruit intelligently. The local exchanges and the associations receive a daily bulletin from the central exchange which outlines the condition of all the

markets the preceding day, states the selling price of all exchange cars, and gives the growers such information as will help them to pack and distribute their fruit to the best advantage.

The limits of this article are too restricted to permit more than a brief outline of the battle that the citrus-fruit growers of California had to wage for fifteen years before the cooperative principle was on a firm foundation. At first, the growers were inexperienced in meeting the attacks of those who were opposed to cooperation among the producers. Powerful financial interests of various kinds were arrayed against them and were organized to oppose them. Vicious attacks were made on the integrity of the officers. The results obtained by the associations were belittled, the growers' association contract was assailed in the courts, and the methods of marketing the fruit were attacked. The most determined efforts were made to show that the growers' organizations were illegally formed. Finally the growers combined with the buyers at one time to market the entire crop, but this incongruous combination of producers and dealers was dissolved at the end of a year and a half.

The history of the citrus industry in California is largely a record of the progress in the cooperative handling and distribution of the crop by the producer and of his determination to receive an equitable share of the value of the labor expended in its production. The battle has been won; the cooperative principle is firmly fixed. It is the balance wheel that gives stability to the industry and to the relations that exist between it and the agencies with which it transacts business.

Fewer serious efforts are made now to break down the cooperative principle among the growers. New schemes of fruit marketing are proposed from time to time, the organizations are frequently attacked in the courts under one guise or another, and other insidious movements are started, all having in view the possible splitting open of the cooperative organizations and a return to the methods of marketing which would destroy the systematic distribution and marketing now in operation and reinstate the chaotic speculative methods that were formerly in vogue. The cooperative movement in the citrus industry is the result of a slow, painful evolution, and the grower does not appear to be deceived by these efforts, no matter how ingeniously and artfully they are conceived.

SELLING THE FRUIT BY COOPERATIVE ASSOCIATIONS.

The cooperative associations sell the fruit in a variety of ways, the method of sale depending on the character and condition of the industry and the practices that have grown up around it. A large proportion of the deciduous summer fruits is sold f. o. b. cars at

the point of production, subject to inspection on arrival in market, or for cash f. o. b. cars, or at auction. Some are consigned to commission merchants. From 25 to 30 per cent of the citrus fruits of California are sold at public auction in the eastern and central-western markets, and a large proportion of the western deciduous fruits is sold in this manner. Among the apple associations it is a common practice to send to the trade in advance of the harvest a catalogue of the probable number of boxes of the different varieties and sizes of the higher grades of fruit that the association has for sale, and finally to sell the fruit to the highest f. o. b. bidder. The lower grades are consigned to commission firms, are sold for cash, or are marketed in other ways.

Few of the organizations, except those that transact a large business—like the citrus-fruit growers of Florida and California, the peach shippers of Georgia, and the deciduous-fruit shippers of California—have attempted to regulate the distribution of their products throughout the country, nor have any serious attempts been made to carry the distribution beyond the wholesale dealer, the broker, or the auction companies. The cooperative method has brought about large economies in the purchase of supplies, in the cost of preparing the fruit for shipment, and in the charges for distribution and sale. It has improved the methods of fruit packing and grading enormously. It has sometimes doubled the net returns to the individual grower for his product. The difference in the price that the association receives for the fruit and that which the consumer pays is often 100 per cent or more higher than the original selling price, and this contracts consumption.

As long as the country is prosperous and the present method of distribution and sale does not cause a disastrous oversupply in the principal markets, the growers will be satisfied to continue the methods now in operation. But as the fruit business increases it will be necessary for the growers' associations to develop methods for increasing consumption. This will be accomplished by a more general distribution of their products, by the development of their associations into marketing organizations, by equalizing the distribution of the fruit over a longer period through a greater use of cold-storage warehouses, by stimulating a greater interest in fruit consumption through systematic advertising, and by placing the fruit in the consumer's hands at a cost nearer that which the producer himself receives. As the American fruit business increases, the grower may be expected to bring about as great an improvement in the methods of distributing and selling his products to the consumer as he has already accomplished in the handling, grading, packing, and preparation of the fruit for market.

MOUNTAIN SNOWFALL OBSERVATIONS AND EVAPORATION INVESTIGATIONS IN THE UNITED STATES.

By Frank H. Bigelow, A. M., L. H. D.,

U. S. Weather Bureau.

INTRODUCTION.

The United States Weather Bureau has been conducting, under the supervision of the writer, a series of investigations of a practical kind in two directions. The first is the invention of an apparatus for catching and conserving the snowfall, especially in remote mountainous places, where observers are not regularly on hand, with the purpose of reporting a season's fall of snow in the form of its water equivalent. The second is an investigation of the laws of evaporation over lakes and storage reservoirs, wherein the snow water from the mountains is held for distribution by irrigation during the summer. These two problems have assumed unusual significance during the past decade in connection with the development of the irrigation projects in the Rocky Mountain and Pacific States under the United States Reclamation Service and private companies, as well as the study of the water resources for power sites by the United States Geological Survey.

COOPERATIVE WORK.

In order to facilitate the study of these interrelated problems and avoid the duplication of work, an arrangement was perfected in 1908, whereby these bureaus of the Government mutually assist each other in establishing stations, securing observers, and discussing the records. In a general way the Weather Bureau comes first in the program, because its duty is to collect the records of precipitation, temperature, and evaporation as part of the meteorological work in the United States. This duty is assigned to the Climatological Division, which has charge of the work of about 4,000 observers and the publication and scientific discussion of the recorded facts of observation. The other bureaus make use of these climatological data in many ways, the engineers of the Reclamation Service in connection with the erection of dams for storage reservoirs and the distribution of the water for farming purposes.

RELATION OF SNOWFALL TO AGRICULTURE.

The amount of snow in the high mountains varies greatly from year to year in consequence of the action of the great currents of moisture-bearing wind, which deposit more or less snow and rain, according to the general laws of circulation in the earth's atmosphere. If there is much snow in the mountains the rivers, the reservoirs, the ditches, and the farms will be abundantly supplied; if

there is comparatively little snow on the high levels, then the engineer must economize all along the line. If a contract is made to supply so many acre-feet of water to a given district and water is not available on account of the causes in the great atmospheric circulation beyond man's control, it is important for the engineer to have his figures of probable water supply before signing the contract. This water once spread out in a great storage reservoir loses a large mass by atmospheric absorption, especially in the arid regions of the West. The water from a pan may evaporate anywhere from 10 inches to 200 inches a year, according to circumstances, and for a given reservoir in a particular climate the annual evaporation will be a certain number of inches. In the humid Eastern States the reservoirs lose by evaporation from 2 to 4 feet of water; in the arid Western States similar reservoirs would lose from 4 to 7 feet of water; the open irrigated land would lose from 6 to 10 feet, and some small elevated areas might lose as much as 15 feet of water annually. When an engineer goes into a new country to construct a reservoir, he wishes to know the general climatic conditions, the temperature, the humidity, and the prevailing wind velocity that he may determine how much water will be lost by evaporation, before he begins to build the dam. If the dam is too high and spreads out the water over too great an area, there will be too much loss by evaporation; if the dam is too low, its storage power will not be great enough for practical purposes.

THE ENGINEER'S INTEREST IN SNOWFALL.

The engineer needs such information in planning the dam for the project and the network of dependent distributing canals. Similarly, for power sites there is an economic connection between mountain snow supply and electric or waterfall power distribution. The Forest Service has much interest in the relations of the growth of trees on the mountains to the moisture-bearing winds; and the Bureau of Plant Industry has a strong reason for studying soil evaporation and plant transpiration. Hence it is easily perceived how wide a field of scientific research is open to the Government bureaus connected with this cooperative work.

THE SNOW FIELDS OF THE WEST.

The productive snow fields of the Rocky Mountains center in two principal foci, the first in Colorado, embracing the headwaters of the Colorado, Platte, Arkansas, and Rio Grande rivers and other smaller streams; the second in Yellowstone Park, in northwest Wyoming, whence flow the Snake, Missouri, Yellowstone, and Shoshone rivers. The Columbia River comes down from the Canadian mountains; and the Cascades, with the Sierra Nevada ranges, are the sources of many short streams in Washington, Oregon, and California. The highest snow-capped peaks of the United States are in the

neighborhood of the 14,000-foot level above the sea, and there are many ranges which reach from 10,000 to 12,000 feet in elevation. The snow fields on these ranges afford beautiful sights for the travelers on the several overland railroad routes that pass within easy view. The snow appears during the summer in long streaks stretching down the mountain canyons and ravines, where it has been blown by the wind and compacted into regular ice blocks often of great extent and considerable depth. Such a snow range is the rampart of the Sierra Nevada Mountains seen from the Owens Valley, stretching north and south for several hundred miles, the glittering white crests shining in the sunlight. The snow melts very slowly at the high elevations where the air is cold at night, and only the top layer feels the rays of the sun during the day.

SOME USES OF WATER FROM MELTING SNOW.

Small lakes are formed as the snow melts, and streams of water run down the gulches, useful for power in their descent and invaluable for irrigation when spread out on the floor of the valleys below. If the water seeps underground, as is largely the case in the Owens Valley, it is found by experiment that about 75 per cent of it evaporates through the surface soil and is lost in the dry atmosphere. The Owens River and the Los Angeles Aqueduct run along the floor of this valley 8 or 9 miles from the rampart of the mountains, and yet only 25 per cent of the water discharging into the valley is available for the supply to the aqueduct. At Bishop, in the same valley, a large power plant transmits electric energy across country to the Goldfield mining district in Nevada, nearly 200 miles distant.

THE FORMATION OF RAIN AND SNOW.

On the western side of the mountains referred to above the irrigation of lands depends upon the snows, which are deposited thereon in winter by the winds blowing in from the Pacific Ocean. The water rises from the surface of the sea or ground by invisible evaporation, the power from which is afterwards used in the form of falling water under the force of gravitation. This gaseous vapor is blown about by the winds from ocean to continent and, rising in the air currents on the mountain sides, is gradually cooled, so that the aqueous vapor turns back to water as snow or rain, and falls on the mountains to be drained off rapidly if rain, or more slowly if snow, till it finally returns to the sea whence it came. We can imagine some drops of water in the blue Pacific a thousand miles from shore changing into vapor, borne along in the balmy breeze across the steamer's deck, thence over the Coast Ranges of California to the slopes of the Sierra Nevadas, where a portion of it turns back to water and is dropped, while a great billow sweeps across the deserts and rises a second time, on the Rocky Mountain ranges of Colorado, where more

of it is condensed. Here the drops divide their comradeship, some flowing to the Gulf of Mexico, gradually to seek their way to Europe and the mountains of the East, others flowing to the Pacific Ocean through the Gulf of California, and so on through an endless succession of migrations and transformations from water to vapor and vapor to water.

THE SALTON SEA IN SOUTHERN CALIFORNIA.

The Gulf of California in ancient days extended northward between the mountain ranges nearly 200 miles beyond its present shore line, and the Colorado River, after cutting its gorge through the high plateau, emptied into the Gulf near the present town of Yuma. The silt-laden waters gradually formed a broad delta across the Gulf opposite Yuma to the Cocopal Mountains, and the river flowed on the hog-back of its own construction with meandering channels, spreading more silt to the north and to the south in turn and thus broadening its own delta. The spring freshets tended to overflow the soft banks, now on one side and now on the other, irrigating the gentle slopes in the most approved though natural manner.

In this way were formed the Salton Basin, whose lowest point in 1904 was 273 feet below sea level, and the fertile Imperial Valley, destined in that hot climate to be a garden spot for early fruits and vegetables. The Colorado broke its banks in 1904–5 and flooded the basin to a depth of 76 feet by 1906, making the Salton Sea, a lake 45 miles in length, 10 to 15 miles in width, and containing 440 square miles of surface. The ancient beaches are still distinctly seen on the land all around the sea at the height of 60 feet above the waters, showing where antique waves washed the shores. The entire country has also undergone elevations and depressions in the geological uplifts and subsidences. The Salton Basin has been filled numerous times with the Colorado floods and emptied again by the processes of evaporation. It is now losing water at the rate of 6 feet annually by evaporation; and is being replenished by inflows from the Blanco and New rivers, with what is practically Colorado River water, to the amount of 12 inches, and by natural precipitation to the amount of 6 inches, so that the actual annual loss is about 4.5 feet or 54 inches. In June, 1910, there was 62 feet of water in the Salton Sea, a loss of 13 feet since June, 1907. It is evident that in fifteen years the Salton Sea will be reduced to small dimensions, though the present annual supply of 18 inches will of course finally feed a small lake as fast as it evaporates, so that if the overflow from the Imperial Valley canals goes on indefinitely there is likely to be maintained a little lake at the lowest depression. The Liverpool Salt Company for years had been mining salt in the lower levels of the basin, deposited from the ancient evaporations, and the present waters are somewhat brackish.

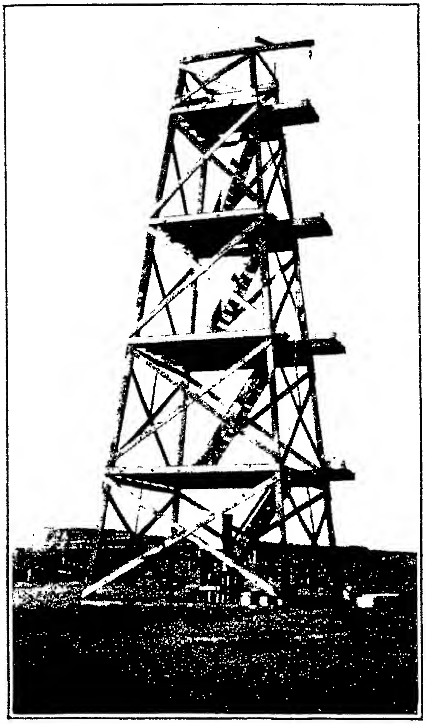

FIG. 1.—TOWER NO. 1, 1,500 FEET INLAND.

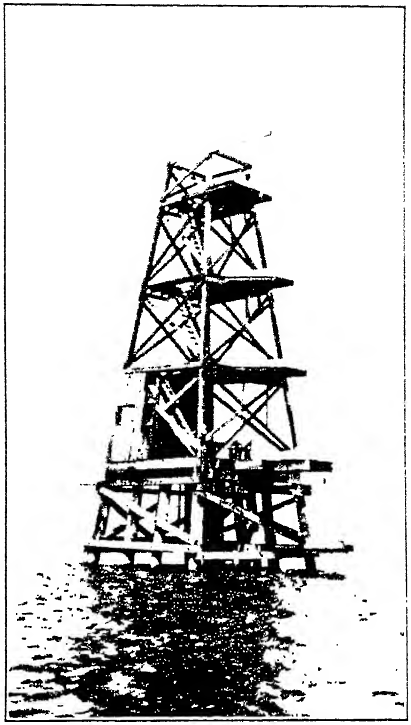

FIG. 2.—TOWER NO. 4, 7,500 FEET AT SEA.

TOWERS FOR STUDYING THE LAWS OF EVAPORATION AT THE SALTON SEA, SOUTHERN CALIFORNIA.

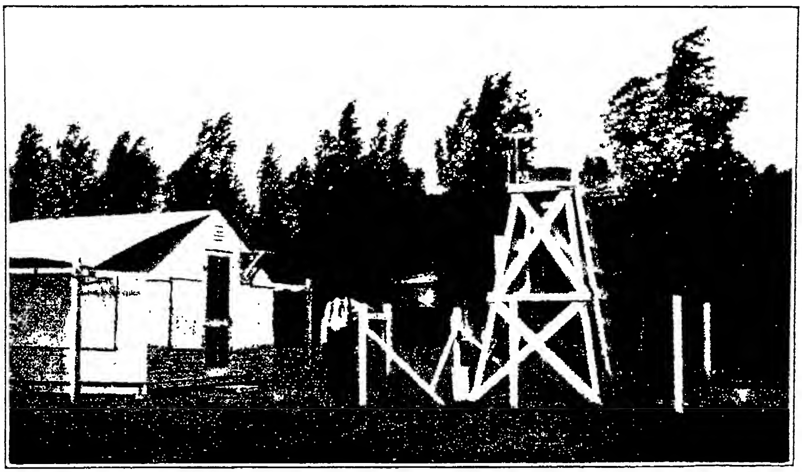

FIG. 3.—OBSERVING STAND, 10 FEET HIGH, FOR STUDYING THE FACTS OF EVAPORATION IN THE UNITED STATES.

In a geographic sense it is a long distance from the lofty, snow-clad crests of the Sierra and Rocky Mountains, where condensation and precipitation as snow and rain occur, to the Salton Sea, where vigorous evaporation is going on. The endless cycle is in process continually in nature on large and on small scales, on continents and oceans, on hills and lakes, on farm lands or on artificial evaporation pans. The scientific study of the laws controlling these physical processes can be conducted in nature's open laboratories in the field, or in man's laboratories beneath a roof. In the one the conditions are free and unrestricted, in the other constrained and incomplete.

On this account the formation of the Salton Sea afforded a large laboratory on a grand scale for studying evaporation, and the mountains a limitless workshop for investigating snow action, stream formation, and water resources generally. It is this vast field of investigation that is now occupying the serious attention of at least five great bureaus of the Federal Government. The procedure is the classification of the laws and the purpose is the practical advantage to the people of the United States. If a small percentage of the capital to be invested in these enterprises be applied to an intelligent study of the problems involved, it will become an insurance against unwise expenditures and improvident projects. This work has been advanced somewhat in three years, and a good beginning has been made, which should encourage further development and more profound study of the numerous difficult scientific questions coming to the front.

RESEARCHES REGARDING THE LAWS OF EVAPORATION.

Many investigations have been made regarding the phenomena and the theory of the evaporation of water from lakes and storage reservoirs in the past 50 years, but—although the amount of literature is very great—very few definite conclusions have been reached. In 1907 the United States Weather Bureau began an extensive study of this subject in cooperation with the United States Reclamation Service and the United States Geological Survey. The principal work was done at the Salton Sea in 1909–10, and at several neighboring stations, while other stations were operated in the Pacific and Rocky Mountain States, as well as in the Atlantic States. There have been about 125 evaporation pans under observation at 25 different localities, some near sea level, some on high plateaus, some in very dry climates, some in very humid climates, in all the latitudes, longitudes, and elevations of the United States, from Eastport and Key West to the Salton Sea and North Yakima. Hundreds of thousands of observations have been made, and their records classified and discussed. The method of attack was to adopt towers and stands with pans at the several elevations from the surface of the

water or the ground up to the height of 40 feet. The lower atmosphere is characterized by considerable changes in the wind velocities from the surface upwards, increasing with the height; in the vapor pressure, decreasing with the height; and some lowering of the temperatures, so that pans placed at the several stages were evaporating under conditions slightly different and gradually changing. At Reno, Nev., five 50-foot towers were erected in 1907 at the city reservoir, and some practical experiences were acquired regarding the facts of evaporation and the formulas to express them. In 1909 a camp was established at the Salton Sea, and heavy towers were erected there, one on the land and three in the water, the farthest in being 7,500 feet from shore. At the subordinate stations 10-foot observing stands were raised, with a pan of water on the ground and another 10 feet above it. The research has been exceedingly complicated and difficult, but many new and valuable facts have been discovered.

A number of special pieces of apparatus have been used and tested. A simple burette tube gives excellent results for general field work, but the micrometer hook gauge is perhaps the most accurate instrument with a very efficient still well. Several pieces of magnifying gauges have been tried, but these need further consideration. An efficient automatic self-register has been in successful operation where a solid support is available. It will be necessary to adopt a standard pan, as a 4-foot pan, and a standard method of observing, since accurate readings of all pieces of apparatus depend upon the kind and the efficiency of the illumination of the water when measured, which is a difficult matter in rough weather and high winds, when evaporation is at a maximum.

A number of interesting special phenomena have been observed, as the change of the vapor pressure from a single diurnal period at the surface of the Salton Sea to a fine semidiurnal period at 40 feet above the water. The vapor blanket from the Salton Sea extends into the desert so as to begin to retard the rate of the evaporation at 1,000 feet inland in the middle of summer. The relative humidity over the sea changes from 75 per cent at the water to 50 per cent at the top of the towers and to 10 or 20 per cent at 1,000 feet inland.

It is found that perfectly satisfactory results can be obtained by observations at 6 a. m. and 2 p. m., the times of minimum and maximum meteorological influences, instead of every four hours of the day (2, 6, and 10 a. m., and 2, 6, and 10 p. m.) at which the regular program of 1909 was executed.

Plate XXVI shows the style of tower adopted both for the sea and land and the observing stands used in the evaporation investigations at the Salton Sea.

FIRE PREVENTION AND CONTROL ON THE NATIONAL FORESTS.

By F. A. Silcox.

Associate District Forester.

THE IMPORTANCE OF FIRE PROTECTION.

No plan of forest management produces results unless it has as its essential feature an adequate system of fire protection; this is fundamental. Fire can wipe out in an hour or two the work of many decades, and it is obvious that the forester, who must wait on an average about one hundred years for results, would be advocating an impracticable policy unless results were reasonably certain. If the crop is to be harvested it must be protected from fire during the time of its growth. It is worse than useless to devise plans to assure future growth if this future growth is to be burned up. The establishment of nurseries for the production of young trees to be planted in the forests and also the reseeding of cut-over areas to insure reproduction would be manifestly fruitless operations if, when the young growth was secured, it were to be destroyed by fires that would necessitate repetitions of the work.

That the fire menace is a real one needs no emphasis. The records of the great Hinckley fire of 1894 in Minnesota, the Fernie fire of 1908 in British Columbia, and the great fires which have recently swept the western United States, are but a very small part of forest-fire history; but they show the possibilities under a combination of bad conditions. The forester can read from old burnt-over areas the history of the past fires and can trace their effects. The record shows a periodic recurrence of bad fires, which seem to come at intervals of from fifteen to twenty years. It is a simple proposition, if timber is to be raised, and if it takes from seventy-five to one hundred and twenty-five years to secure the crop, some adequate method must be found to prevent the periodic recurrence of severe fires. Success or failure in meeting this problem means success or failure in the application of practical forestry.

THE CHARACTER OF THE REGION TO BE PROTECTED.

To appreciate the problem one must have a clear conception of the type of country in the National Forests, and also some idea of their extent. Except for small areas in Florida, Minnesota, Michigan, Kansas, and the Dakotas, the National Forests include the great mountain watersheds of the West. They lie along the crest of the main divides of the Rockies, the Cascades, and the Coast ranges.

The country is therefore rough and mountainous, cut by gorges and canyons, and broken by almost impassable ranges and unscalable peaks. There are two general forest types—open park areas with timber confined to the north slopes and densely forested regions where timber grows on both exposures. In the main the park country is east of the principal divides and the very heavily timbered regions are to the west. (Pl. XXVII, fig. 2; Pl. XXVIII, fig. 1; Pl. XXXII, fig. 2.)

The work of fire prevention and control, although theoretically the same for both types, differs essentially in practical application. Each National Forest, the unit of administration, contains from 1,000,000 to 2,000,000 acres. This is equivalent to an area from 30 to 50 miles wide and from 40 to 60 miles long. To protect such an area from fire, especially with the difficulties of transportation and communication, is exceedingly difficult.

ECONOMIC LOSSES.

In the National Forests, exclusive of Alaska and Porto Rico, there is estimated to be 530,000,000,000 board feet of timber, valued at approximately $1,060,000,000, exclusive of its protective value, which is great. Fire has exacted its toll in timber each year to the amount of approximately $200,000, while the loss outside the Forests has amounted to $50,000,000 annually. In very dry years, such as the season of 1910, the loss runs very much higher.

The burning of the timber means not only a loss in stumpage, but a community loss in wages of approximately $10 for every thousand board feet destroyed. When it is realized that it is not uncommon for the timber to run from 50,000 to 100,000 board feet per acre in the dense forests of the Pacific Northwest, it is clear that it does not take very many burned acres to run the figures up to six or seven places. For example, during the 1910 fires in western Montana and northern Idaho the loss was 6,000,000,000 feet board measure, with an estimated value of $20,000,000. Aside from the value of the timber the danger to lives and to town property from these large fires is a very real one. The fate of Wallace, Idaho; of Fernie, British Columbia; of Chisholm, Minn., and of many other towns emphasizes this. (Pl. XXX, fig. 2.)

CAUSES OF FIRES.

Always the first question asked when the fires are mentioned is: "How do all these fires get started?" The causes are many, but practically all can be classified as preventable. The usual causes in the order of their frequency are: Railroad engines; lightning; careless campers, fishermen, and hunters; settlers burning brush to clear land for cultivation; logging engines and sawmills; malicious incendiaries.

FIRES STARTED BY LOCOMOTIVE SPARKS.

The detailed reports of the Forest Service for 1909 placed the railroads first as being the most common cause of fires on the National Forests. Out of 3,138 fires reported, 1,186 were caused by locomotives, and their setting was due to three principal reasons—the use of coal as fuel, the lack of proper clearing of the right of way, and the non-use or misuse of spark arresters.

The railroad's right of way is usually from 100 to 200 feet wide; in many places within the National Forests the brush and débris has never been properly cleared up on the right of way after the larger timber has been removed, and dry punk logs and débris form the most inflammable kind of material for ignition by a spark from the engine. Furthermore, the heavy grades in the mountains require a full and forced exhaust on the engines in order that sufficient steam may be kept up. Most of the spark arresters now in use interfere with the draft and, as a result, the wire screen must be knocked out or opened up so that the engine may get up the difficult grades. The more modern and larger locomotives have a return draft by which the larger cinders are forced back to the fire box before being emitted through the stack. Despite the improvement, both in engines and spark arresters, the railroads still hold first place as a cause of forest fires.

FIRES CAUSED BY LIGHTNING.

The second great cause of fires, and the only one which can be classed as nonpreventable, is lightning. During dry seasons many electrical storms occur over mountain regions and set numerous small fires when lightning strikes a tree and starts a fire in the débris and humus on the ground below. The scarred trunks of old trees with a straight or spiral scar through the bark, from top to root, show the effects of lightning. These lightning-scarred trees are readily found in any large body of timber. During the dry season of 1910 there were many electrical storms, and innumerable small fires were found immediately afterwards. If the storm is accompanied by rain there is, of course, little or no danger; but it is more usual for these mountain electrical storms to be unaccompanied by rain. In 1909 there were reported 294 fires originating from this cause.

LACK OF CARE BY CAMPERS.

Approximately 407,000 people go to the National Forests for recreation each year. Many of these people are out for a week or two at a time to hunt or fish or just to enjoy outdoor life in the hills. Unfortunately, many of the campers either are careless or are ignorant of the proper handling of camp fires. The carelessness takes the form of leaving the fires unextinguished, or in throwing about cigar

or cigarette stumps or knocking out pipes. The usual Turkish cigarette is a slow fuse that burns continuously to the end. The ignorance is shown in the failure to keep camp fires small and in not building them in fairly open spaces and away from punk logs and débris. Frequently a large fire is built when a little one would serve the purpose better and be safer. Everyone who has been in the hills has run across the skeletons of old tepees that mark the Indian camping grounds. The fireplace gives the impression of having been used for generations. It is simply a depression in the ground about 2 feet square, surrounded by a cleared space about 10 feet in diameter. Their example might well be followed.

CLEARING LAND FOR SETTLEMENT.

The clearing of timbered lands for cultivation by settlers contributes materially to the fire danger each season. The débris must be burned and, in many cases, for lack of market, even the logs themselves are thus disposed of, in order to clean up the land. Not long ago little thought was given to the man who set fire to brush on his own land. If the fire got away and damage was done, civil action was sometimes taken through the courts, but more often nothing was done. Here, again, what is wanted is not legal reprisal for damage, but a prevention of the damage itself. Recognizing that fire is a common danger, many States have taken the stand that anyone burning brush must conform to certain well-defined rules as to time and attendance, the violation of which means the infliction of a severe penalty. Briefly, these rules require that no burning shall be done during the danger season from June 1 to October 1, though in order not to impose a hardship provision is made whereby the settler may procure a special permit from the fire warden; that the brush shall be in small, compact piles, so that the fire is always under control; that contiguous bodies of timber shall be made safe by cutting small fire lines where necessary; and that there should be on hand at all times a sufficient number of men to control the fires which are set out. There will, of course, always be some danger from these fires, but it can be reduced to a minimum if the rules are carried out. The settler himself is coming to realize that the danger is a common one and that it is just as much to his interest to exercise the greatest care as it is to his neighbor's. In 1908 sixty-eight fires were reported on the National Forests as starting from this source; in 1909 there were one hundred and eighty-one.

THE DANGER IN LOGGING OPERATIONS.

The increasing use of donkey engines in logging operations has brought about a corresponding increase in fires, and logging locomotives passing through cut-over areas are almost sure to give

FIG. 1.—A RANGER STATION IN THE TIMBER.
[Small patch cleared to afford pasturage for horses.]

FIG. 2.—WHERE THE TIMBER LIES ON BOTH SLOPES HEAVY AND DENSE.
[Fuel for the fires unless protected by trails, telephones, and patrol.]

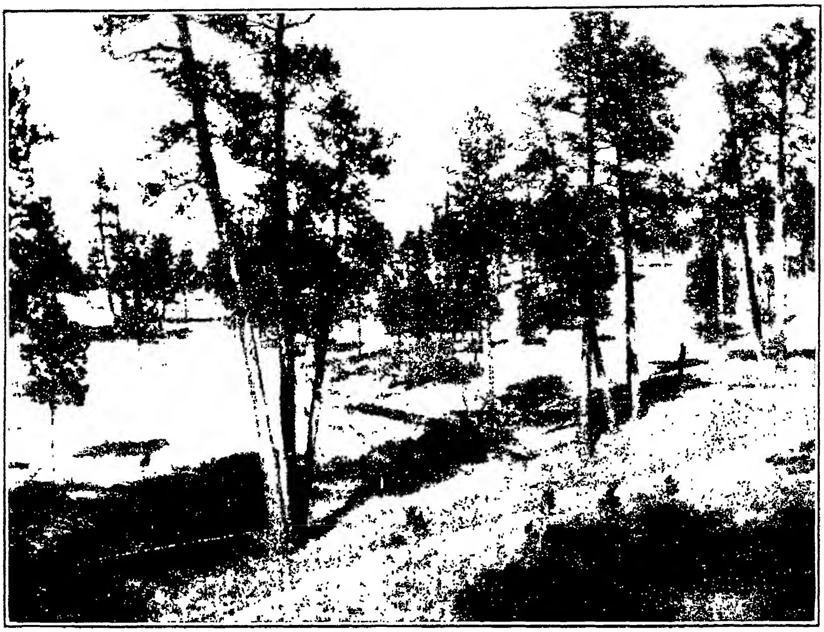

FIG. 1.—THE OPEN YELLOW PINE TYPE, WHERE THE TIMBER HANGS TO THE NORTH SLOPES.

[Easy of access and fire danger small; confined mostly to grass and ground rubbish.]

FIG. 2.—RANGERS GETTING FIRE-FIGHTING TOOLS FROM A BOX-CACHE ALONG THE RAILROAD.

[Shovels, mattocks, saws, and axes are kept in readiness. Each ranger keeps a key to the box.]

FIG. 1.—TRENCHING TO MINERAL SOIL TO STOP A GROUND FIRE.

[High winds cause the fire to run in the tops of the trees, rendering trenching valueless; only stopped by back firing.]

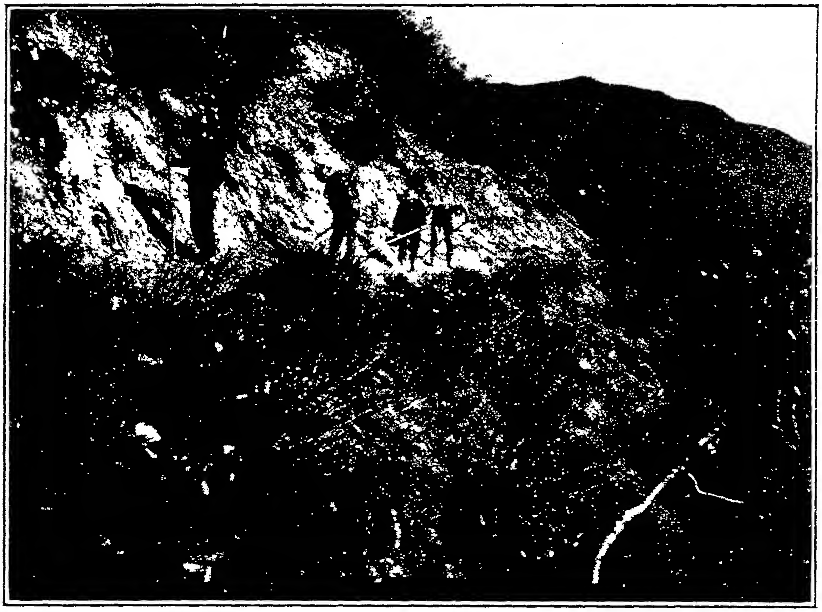

FIG. 2.—GRADING IN A MOUNTAIN TRAIL IN A ROUGH PLACE.

[Note carefully the general type of topography. Trails 18 inches wide and 8-foot clearing cost from $50 to $300 per mile.]

FIG. 1.—SAVING MANY LONG, HARD TRIPS AND TIME BY ESTABLISHING TELEPHONE COMMUNICATION.

[Strung to trees by forest officers.]

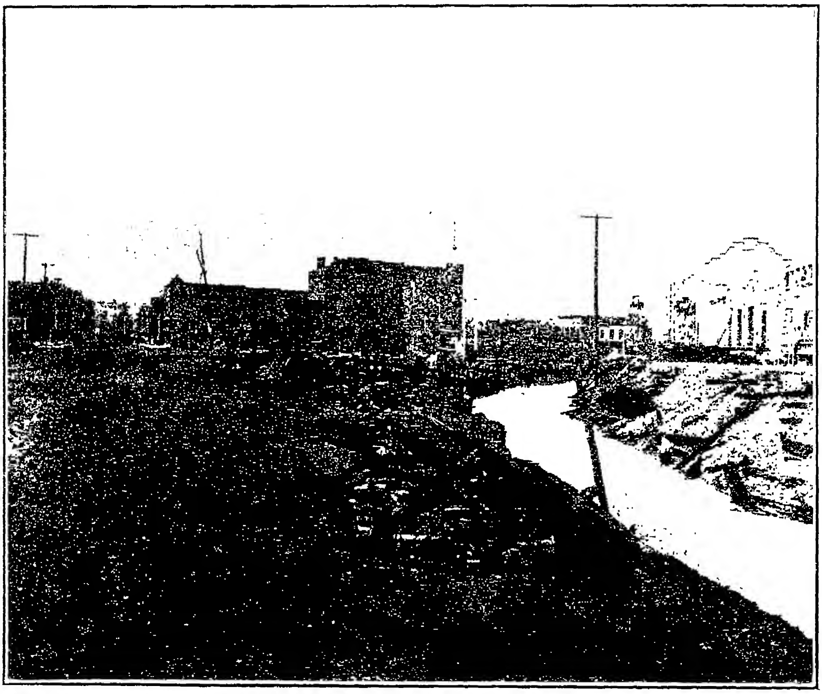

FIG. 2.—WALLACE, IDAHO, AFTER THE FIRE.

[Property of great value destroyed and many lives endangered. Just one of the items.]

trouble. Small portable sawmills cause many fires. The rigid enforcement of regulations requiring the use of adequate spark arresters, clearing up and burning, at proper seasons of the year, the débris resulting from logging, and the strict requirement that all employees exercise the greatest precautions against fires, is going a long way toward eliminating logging as a factor in increasing the number of fires. On the National Forests thirty-eight fires were reported in 1909 from this source. Some lumber companies have prohibited smoking in the woods, just as they prohibit it in their mills. Certainly there is as much reason for one as for the other.

INCENDIARY FIRES.

Many fires unquestionably have incendiary origin. Varied motives prompt this act, which is as hard to explain or to anticipate as any other wanton violation of law. Some are set for malice, or to "get even" for real or fancied grievances. Without question, some fires are set to create fire-fighting jobs for some of the human flotsam and jetsam of that great tide which ebbs and flows over the country, following the crops, railroad construction work, and other more or less temporary employment.

The National Forest reports for 1909 showed that ninety-seven fires originated in incendiarism. In all States the penalty for this offense is very severe, and the Federal penalty is $5,000 fine or two years in the penitentiary, or both. The laws are stringent enough and convictions could unquestionably be secured, but the difficulty is to catch the offender and prove the case. The Forest officers have the authority to arrest without warrant a man seen setting a fire, but so far practically no arrests of this character have been made. The incendiary not only covers his tracks, but the fire itself effectively wipes out any clues.

MISCELLANEOUS CAUSES OF FIRES.

In addition to those from well-known causes, there are many fires which occur from miscellaneous causes not easily classified. The burning wad from a shotgun cartridge and the concentration of the sun's rays through a glass bottle are examples. Many of those reported as of unknown cause, however, are undoubtedly ascribable to one or another of the well-recognized causes, though to which one can not be determined. Those reported "unknown" from the National Forests amounted to seven hundred and fifty-eight in 1909.

METHODS OF PREVENTION.

Knowing the main causes of the fires, it is possible to consider intelligently the most practicable measures of prevention.

FOR RAILROADS.

To prevent the innumerable small fires set by railroads oil must ultimately be used as a fuel. An efficient spark arrester which will keep large glowing embers from being thrown out into the dry grass, brush, or débris usual along the right of way will assist greatly, but will not entirely prevent fires. The difficulty lies in securing a wire screen with a mesh small enough to catch the sparks, yet not so small as to interfere with the exhaust. Many different styles of screens have been devised in an attempt to overcome these difficulties. The use of a large-meshed screen is being made possible to some extent by special arresters which catch the larger cinders in a cuplike rim on the inside of the stack, the theory being that the heavier sparks, under forced draft, are held by centrifugal force close to the perimeter of the stack; therefore, any such obstruction properly placed on the inside of the stack should stop the large cinders, which are the main cause of the fires.

There must be some way to prevent those which do get away from starting fires, and the only effective one is to clear the right of way of all inflammable material. There should be no standing timber, no punk logs and débris, and it should then be burned over periodically, under careful supervision, to prevent further accumulation of inflammable stuff. Through open country it is best to plow a furrow or two at the outer edge of the right of way to serve as a fire break. The method to be adopted depends to a great extent on topography. Two to four furrows on each side of the track are usually sufficient. In addition, it is necessary to patrol the right of way immediately after every heavy freight train, by a man on a speeder.

Caches of fire-fighting tools should be located at each section house and at other stations along the right of way. These may be boxes similar to those used by contractors, placed at the most strategic points. Telegraphs and telephones for summoning assistance are of utmost importance in controlling railroad fires. Since the saving of time is the main consideration in handling a fire, provision must be made to use employees of the railroad for fire fighting, and this applies particularly to section gangs and other manual laborers immediately available. (Pl. XXVIII, fig. 2.)

Appreciating the common danger, the Government and certain railroads have outlined, and in some cases have put into effect, a practicable cooperation. Such cooperative agreements are in force between the Forest Service and the Northern Pacific and the Great Northern railroads, which traverse National Forests in Idaho, Montana, Washington, and Oregon.

Under this cooperation the railroad agrees: To clear and keep clear its right of way of all inflammable material to the satisfaction

of a duly authorized Forest officer; to use effective spark arresters on all locomotives; to grant the use of pin room on the poles on its rights of way for wires of the Government, provided such an arrangement can be made with the company that owns the poles; to permit use of tricycle speeders for patrol purposes during the dry season; to furnish such assistance as is available in case of fire; to pay all expenses directly to the men employed in fire fighting, if the fire is within 200 feet of the right of way (this is made 100 feet in some cases); to allow Forest officers to ride on certain designated freight trains when provided with proper transportation; to notify the nearest Forest officer in case of a fire.

On its part the Forest Service agrees to patrol the right of way during the dry season; to supervise the clearing of the right of way; to construct such telephone lines connecting Forest officer's headquarters as may be necessary; to furnish caches of fire-fighting tools at convenient points along the right of way; to give to the railroad all timber cut in clearing its right of way or an additional strip not to exceed 200 feet in any case, provided the timber does not run over 10,000 feet per acre; to pay directly the men employed in fighting fire outside of the 200-foot strip (but if the railroad is later found to be responsible for the fire the United States is to be reimbursed); to notify the nearest station agent of any defects found in the tracks by the patrolmen.

Both parties to the agreement are bound: Not to terminate agreement during the fire season; not to terminate it outside of the fire season without 30 days' notice.

FOR CAMPERS.

To prevent fires, all campers should observe the following simple rules: Clear thoroughly of débris a space of about 10 feet around the place where the fire is to be built. Build small and not large fires. Never leave a fire burning, no matter how safe it might appear; put it out, either with water or dirt, and use special precaution to put out punky logs, since they burn for a long time.

These three simple rules, if followed, will prevent any conflagration from camp fires. Campers should not risk themselves or jeopardize others who wish to enjoy the woods. If they are careless the severest penalty under the law should be inflicted.

FOR FARMERS.

The system adopted by many of the timbered States to make effective a closed season during which time no brush can be burned without permit is helping tremendously to reduce the danger from settlers burning brush. Many States now provide for a closed season and compulsory brush burning during such time as it is safe.

PREVENTION THROUGH LEGISLATION AND EDUCATION.

Plainly noticeable on every road or trail in the National Forests are fire-warning notices. The essential feature of these notices is an outline of the Federal law against setting or leaving any fire. It states that malicious fire setting is met with a punishment of $5,000 fine or two years in prison or both; careless fire setting with $1,000 fine or one year in prison or both.

Practically all of the States have enacted forest-fire laws. With very few exceptions all of the early legislation provided for penalties rather than for fire prevention. The more recent acts emphasize preventive measures. They provide in brief for the creation of fire districts upon the request of any timber owners in a given locality; the selection of a fire warden by the petitioners and ratification of his appointment by the State; the prohibition of brush burning during the dry season unless a permit is secured from the State fire warden; the compulsory burning of slash during the early spring or late fall in order to eliminate danger from logging.

In practically all of the western States, but more particularly in Idaho, Oregon, Washington, California, and Montana, aggressive steps are being taken in the direction of adequate fire protection.

COOPERATIVE ASSOCIATIONS.

Many of the forestry and conservation associations of the West are carrying on an active propaganda of education not only among the timber owners, but among the people at large. That this work is achieving results is shown by the fact that the lumber owners themselves have organized associations in which each one of the members is assessed according to his acreage. The funds cover expenses of hiring guards and temporary fire fighters, of keeping horses, and of equipping men with tools. The primary purpose of this educational campaign is to impress in a vivid, lasting way the meaning of a forest fire in losses to the Nation, to the State, and to the local community.

Such organized associations are of the greatest practical benefit to the National Forests where the holdings of lumber companies and the National Government are intermixed, and cooperation prevents duplication, makes the work effective, and properly places expenses and responsibilties. Cooperative agreements provide for a division of the territory into cooperative districts, which districts are determined by the topography and extent of the private and Government holdings and of the areas which are not included in either; a prorating of the expenses of fighting fires in the cooperative district on the basis of the proportion of holdings; a division of each cooperative district into patrol units and a definite agreement at the beginning

FIG. 1.—THE PACK TRAIN ON A MOUNTAIN TRAIL.
[Travel by trail either by foot or horse is fairly rapid; without trails it is practically impossible.]

FIG. 2.—BIRD'S-EYE VIEW OF THE LOOKOUT PATROLMAN.
[Note the immense scope of country covered. With means of communication fires can be promptly located and reported.]

FIG. 1.—FIRE LINE IN A FOREST. A GROUND FIRE RAN UP TO THE LINE AND THERE STOPPED.

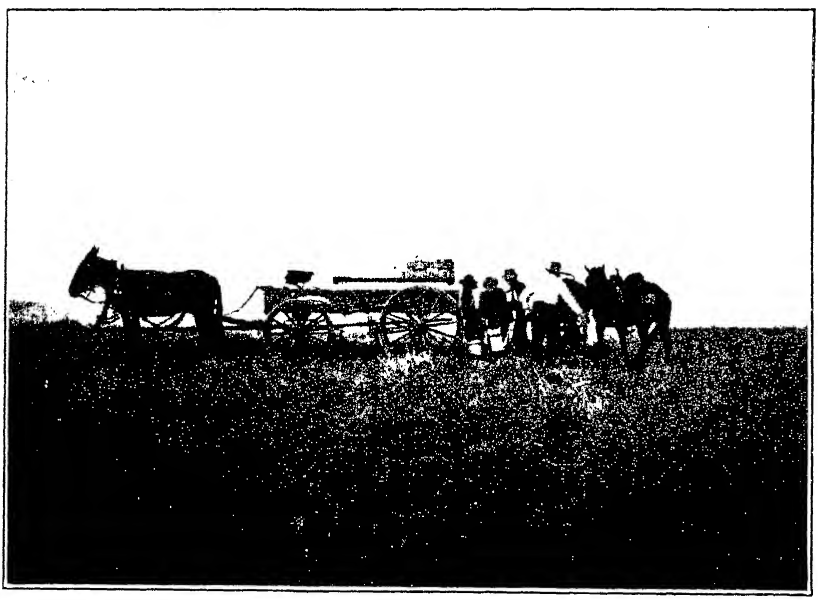

FIG. 2.—THE EASY TRAVEL THROUGH THE OPEN PARKS OF THE YELLOW PINE COUNTRY.

[Plenty of feed and water.]

of each fire season on the distribution and responsibilities of the men assigned to these units; the appointment of the association's patrolmen as Forest Service guards to give them better authority to cope with executive problems and to make arrests for violation of Federal fire laws. In like manner the Government guards and rangers are appointed State deputy fire wardens, which gives them authority to make arrests under the State law and also to incur expenses and provide for the prorating of the accounts paid by the association.

This plan of agreement has been found most effective under the severe test of the extremely bad fire season of 1910. It has meant the elimination of duplication both in patrolling and actual fighting; it has brought about system as against an emergency arrangement; it has culminated in a mutual effort to cope with a common danger through securing the greatest degree of efficiency by both the association and the Government.

Similar cooperative agreements are entered into with individual lumber companies or with owners who are not members of the association, where their holdings are of sufficient acreage to make it advisable. Ordinarily the protection of these areas would have to be assumed by the Government in order to protect its own holdings, and this plan of cooperation places the responsibility for protection control on these privately owned lands where it belongs—on the private owners themselves and not on the Government. The value of this kind of cooperation can not be overestimated in the general plan of fire protection in the National Forests.

CONTROL OF FIRES.

It is axiomatic that to control fires they must be discovered and reached when they are small. In a city the location of the fire-alarm boxes so that a report of the fire can be sent to the engine houses; the arrangement whereby anyone may turn in the alarm and can therefore act as a patrolman; the use of electrical appliances for transmitting the alarm; the complete readiness of men, horses, and engines to move on the first signal—or the substitution of the motor for the horse-pulled engine; the readiness of all vehicles and pedestrians to give entire right of way to the engines—all these bespeak a combination for most quickly locating and reaching a fire. On the National Forests the problem in essence is the same. Fire engines scarcely can be used, but the reporting of fires, the quick calling for assistance, and the keeping in readiness of necessary tools and equipment can be had.

THE NATIONAL FOREST FORCE.

First, the Forest is divided into ranger districts to distribute the patrol force properly and to fix the responsibility for a specific piece of territory on a permanently employed ranger, who can become

thoroughly familiar with the country in which he is to work. This is important, since much depends upon the ranger's knowledge of the topography of his district. The size of the ranger district varies, but under present conditions is altogether too large. In no case should it include more than two townships, or approximately 72 square miles. Since the ranger must not only oversee the fire-protection work, but must handle the administrative work, such as making estimates, maps, and reports on timber sales; must exercise general supervision over the construction of roads and trails; and make examination of claims, it is necessary to have additional men to assist in patrolling the territory. These additional men are needed mainly during the fire season—from June to October—and are employed temporarily as guards to assist the ranger in patrol work. To properly distribute these additional men, the ranger subdivides his district into patrol units, to each of which he assigns a Forest guard. From 1 to 10 Forest guards are assigned to a ranger, depending, of course, on the size of his district and the comparative danger from fires. (Pl. XXVII, fig. 1.)

The unit of patrol varies according to the character of the country. In the very heavily timbered regions of the coast and Northwest one man can not adequately cover, even with every facility for readily getting over the country, more than from 25,000 to 30,000 acres. In the more lightly timbered regions, where there are a great many open parks, one man can cover from 50,000 to 60,000 acres. This would mean for a Forest of 1,000,000 acres a patrol force, not including rangers, of thirty-three men.

LOOKOUT POINTS.

After dividing the Forest into ranger districts and subdividing the districts into patrol units, with a man in charge of each, it is still necessary to make sure that these men are in a position to render effective service. The ranger must select certain lookout points and ridges from which he can see over his entire district. A view from these high points will, in many cases, be worth a great deal more for discovering fires than patrol lower down; hence these points are carefully selected and coordinated to give primary control of the entire Forest. They are generally high isolated peaks from which an unobstructed view may be obtained. If possible they should be in sight of each other, so that two men can locate a fire accurately by taking triangulation compass bearings. (Pl. XXXI, fig. 2.)

Yet these lookout points and ridges are of little value if after the fire is discovered there is no way to get to it quickly, because of a lack of trails, or no way to call for immediate help. Travel without trails through mountainous regions, over windfall and through brush, must be on foot; the time lost in getting to a fire is a serious matter. Where

the guard himself possibly could put the fire out when he first discovers it, provided he could reach it quickly, it might take an army of men to control it after a delay. In most cases ready assistance can be had only along the railroads and in the settled lower valleys.

TRAILS AND TELEPHONES.

In many cases help is from 10 to 60 miles away. With a telephone line the distance can be spanned in five or ten minutes; to travel it may take as much as four days. Unless, however, it is possible to bring in men, supplies, and tools over road or trail, the delay is still greater, for then a trail must be cut for pack horses. (Pl. XXIX, fig. 2; Pl. XXX, fig. 1.)

Permanent trails must be built to make the country accessible. They should be along all of the main streams and ridges as trunk trails, then up the tributaries and on the spurs as laterals. The system must be complete, comprehensive, and coordinated in order to make it possible for a man on horseback to reach any portion of his fire patrol unit within a few hours. In case the fire gets a start and it becomes necessary to bring in a number of men and many supplies, even better means of transportation must be provided. These can be secured only through wagon roads as far as they can be constructed and then trails for pack animals. Pack trains of from eight to thirty horses should be kept on each Forest where there is risk of delay in getting horses from the outside. These horses may be distributed over the Forest on trail construction work, or used for packing supplies and carrying mail to the patrolmen away back in the hills, so that the men will not have to leave their stations to come out for two or three days at a time during a critical period.

When a large fire occurs which can not be handled by the local force of rangers and guards and assistance is needed, the telephone gets word to the supervisor, who, in most cases, is in a town on the railroad, and help is sent in. The horses are called into service from their routes or construction work and put to packing supplies to the fire camps. The caches of tools at strategic points throughout the Forest contain enough tools to equip from ten to fifteen men. Larger caches at central points of distribution in the Forest provide against the loss of time which would result if they had to be packed in, in addition to the food supplies for the men. (Pl. XXXI, fig. 1.)

FIGHTING FIRES.

In general there are two kinds of fires, ground and top. All fires, with the exception perhaps of some started by lightning, begin as ground fires. A ground fire runs in the grass or underbrush, while the top fire reaches into the crowns of the trees. Crown fires occur and run only under the impetus of a good wind. Such a wind throws

fire brands and sparks for miles, setting innumerable small fires which only need the right combination of wind and weather to produce a general conflagration such as occurred during the season of 1910.

To stop the ground fires, trenches are dug from 2 to 4 feet wide down to mineral soil, the brush and débris being thrown away from the fire. When the fire reaches this line, unless it is burning very intensely, under a high wind, it will stop. Patrols are established along this entire fire line to keep it from crossing. Some men fight these ground fires by getting very close to them, simply following the fire line as it extends; others cut their line some distance ahead and then back fire from the line. Both methods are good, but are applicable to different types. In open stands of timber close fighting is best; in the heavy underbrush close fighting is out of the question. The tools used for trenching are the mattock or grub hoe, shovel, axe, and cross-cut saw. Each crew usually contains from fifteen to twenty men, having tools in the proportion of two mattocks for each shovel or axe. For example, fifteen men would be using five shovels or axes and ten mattocks. Such a crew can build about 1 to 2 miles of fire trenches in a day. (Pl. XXIX, fig. 1; Pl. XXXII, fig. 1.)

Under high winds the ground fires may start top fires, that is, the fire runs up the dry moss on a tree or catches some of the lower branches, which in turn catch the next, and the crown fire is started. The fire crew then selects a place some distance ahead of the fire and puts in a trench and also cuts the trees for a space about 20 feet wide. A back fire is set near enough to the advancing fire for the back draft to bring the two together and cause them to burn out. With a hurricane-like wind the only thing to do is to get out of the way as quickly as possible.

PROMISING NEW FRUITS.

By William A. Taylor,
Pomologist and Assistant Chief, Bureau of Plant Industry.

INTRODUCTION.

In a country possessing the broad area of the United States, with its wide range of climatic and soil conditions, the question as to what varieties of fruits should be selected for planting is of necessity an important one. While with some of the fruits in some sections experience with certain varieties has proved them to be so satisfactory that there is little incentive to seek better sorts, this is far from true with regard to most fruits in most sections. And while in general it is to be expected that the varieties best adapted to a particular region are such as originated therein, there are many conspicuous instances where varieties have found very congenial homes at points far remote from their places of origin and under climatic and soil conditions very different from those places.

The exceptional success of such varieties as the Yellow Newtown apple in portions of Virginia, Oregon, and Washington; the Jonathan apple in Illinois, Colorado, California, and Idaho; and the Esopus (synonym *Spitzenburg*) apple in portions of Oregon and Washington, all of which varieties originated in eastern and southeastern New York, are cases in point. Such examples should encourage the systematic testing of promising new fruits as they come to notice from time to time throughout the climatic range of their respective species or groups. Such testing should, of course, be done in a small way rather than through commercial plantings, particularly when the test is to be made in a locality where conditions differ widely from those to which the sort is known to be adapted. With the tree fruits a few buds or scions of the new variety afford a sufficient start to quickly determine its probable value for planting, while with the small fruits a few plants or cuttings are sufficient, if so handled that they can be fully contrasted with the proved standard varieties of the section. Half a dozen trees reserved for use as stock trees upon which to top-work new sorts afford adequate opportunity for such experimentation on the average fruit farm if used with wise discrimination. The results obtained from such an experimental plat not infrequently point the way toward very important varietal readjustments of commercial plantings sooner and more accurately than can be done in any other way.

One purpose of this article, in continuation of similar ones printed in the Yearbook since 1901, is to call the attention of fruit growers generally to new and little-known sorts that are worthy of their attention, and to encourage the testing of such in different sections of the country. The Department of Agriculture does not distribute these varieties for experimentation except as indicated.

LOWRY APPLE.

SYNONYMS: *Lowry Seedling, Dixie, Mosby's Best, Mosby's Best Red Winter.*

[PLATE XXXIII.]

EARLY HISTORY.

The original tree of the Lowry apple stood on a farm owned by Mr. John Lowry (deceased), 3 miles south of Afton, Nelson County, Va. Though the variety first began to attract attention about sixty years ago,[1] only within the past few years has its probable commercial value been appreciated. Even at the present time its planting is chiefly confined to the Blue Ridge region of Virginia.

It appears to have been first propagated about 1880[1] by Mr. John Wright[2] (deceased), of Avon, Va., and by Mr. W. G. Lobban,[3] the latter making grafts on the farm of Mr. G. W. Lobban, near the "John Lowry place." It was known locally at this period under the name Lowry, or *Lowry Seedling*. About 1890 Mr. Wright furnished scions to Mr. Elisha Robertson (deceased), who operated a nursery at Yancey Mills, Albemarle County, Va. Mr. Robertson gave it the name *Dixie* about 1895, and appears to have been the first to propagate it commercially. After Mr. Robertson's death it was propagated by Mr. A. F. Mosby (deceased), proprietor of the Richmond Commercial Nurseries, Richmond, Va., and by him named *Mosby's Best.*[4] More recently it has been grown in several other nurseries.

The original tree died about ten years ago, having become weakened, it is said, by the excessive cutting of grafts from it.[3]

DESCRIPTION.

Form roundish to roundish oblate, sometimes slightly ribbed; size medium; cavity regular, medium in size and depth, with gradual slope and russet markings; stem moderately long, fairly stout; basin regular, medium to large, with gradual slope, furrowed; calyx segments small, converging; eye large, open; surface generally smooth; color yellow, washed with mixed red and splashed and brokenly

[1] Letter from W. H. Goodwin, November 21, 1910.
[2] Letter from J. T. Critzer, December 9, 1910.
[3] Letter from S. H. Arnall, December 24, 1910.
[4] Letter from W. T. Hood, October 17, 1905.

striped with rich crimson; dots conspicuous, yellow; skin medium thick, tenacious; flesh yellowish, rather fine grained, breaking, moderately juicy; core conical, clasping, of medium size, nearly closed; seeds plump, of medium size, brown, varying from few to many; flavor mild subacid, pleasant; quality good to very good. Season from December to February in the Piedmont, Blue Ridge, and Valley regions of Virginia, where it has been more largely grown than elsewhere and where it is highly recommended by those who have most experience with it.

Though milder in flavor than most of the varieties highly prized for dessert use, it possesses many desirable characteristics and is considered worthy of testing for commercial purposes in eastern apple districts from Pennsylvania southward. The tree is a fairly thrifty grower and good bearer.

The specimen illustrated in Plate XXXIII was grown in 1905 by Mr. Hugh Foster, Afton, Va., who at that time owned the farm on which the variety originated.

KINNARD APPLE.

SYNONYMS: *Kinnard's Choice, Kinnaird, Kinnaird's Choice.*

[PLATE XXXIV.]

EARLY HISTORY.

The Kinnard apple has long been in cultivation in central Tennessee, Virginia, North Carolina, and some other sections of the South. While therefore not entitled, strictly speaking, to consideration as a new sort, its adaptability to a much wider climatic range has recently become apparent.

This variety originated as a chance seedling in Williamson County, Tenn., on a farm then owned by Mr. Claiborn H. Kinnard, on the headwaters of the west fork of the Harpeth River, about 8 miles southeast of Franklin, the county seat, and 2½ or 3 miles north of what is known as the Duck River Ridge.[1]

The date of origin is unknown, save that it was some time prior to 1850. The original tree is said to have been discovered in a thicket and to have been in fruit when it was first found.[2] The variety was apparently first propagated, commercially, early in the fifties, in a local nursery operated by one "Judge" George Andrews, and it is reported to have been named *Kinnard's Choice* by him.

The earliest published description appears to have been that of Charles Downing, in 1872,[3] who described it as *Kinnaird's Choice.*

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[1] Letter dated November 28, 1910, from Judge H. G. Jefferson, whose father, now in his ninetieth year, boarded with Claiborn Kinnard about 65 years ago.

[2] Letters from Chas. L. Williams, January 5 and 14, 1911.

[3] First Appendix to "Fruits and Fruit Trees of America," p. 18.

The original tree has been dead some 18 or 20 years, having been blown down during a storm. This tree was some 35 feet in height and its trunk was about 2 feet in diameter.

DESCRIPTION.

Form oblate, ribbed; size medium to large; cavity regular, large, usually with gradual slope and russet markings, sometimes lipped; stem rather short, moderately stout; basin usually regular, medium to large with gradual slope, furrowed, frequently knobbed; calyx segments small to medium, converging; eye medium, closed or partially open; surface smooth, except for occasional knobs and patches of russet; color yellow, overspread with red, usually indistinctly striped with dark crimson; dots numerous, yellow, russet, some aureole; skin rather thick, tenacious; flesh yellow, moderately fine grained, breaking, juicy; core oval, clasping, small, usually closed, sometimes partially open; seeds numerous, plump, of medium size, brown; flavor subacid, rich; quality good to very good; season from fall to midwinter.

The Kinnard apple is of the Winesap group and is adapted to the same general conditions as the Winesap, but it apparently succeeds considerably farther south than that popular old sort. During recent years it has shown special adaptability to the Piedmont and Blue Ridge regions of Maryland, Virginia, and the South Atlantic States. In the mountainous portions of northern Georgia it develops to a very high degree of perfection. While it has been highly esteemed for many years in central Tennessee in the region of its origin, it is also succeeding well as far south as northern Louisiana and northern Texas. It appears worthy of testing in the apple districts of the Rocky Mountains and Pacific coast regions. In northwestern Arkansas it has been found rather susceptible to apple scab—apparently more so than most varieties grown there—but this failing does not appear to have been reported from other sections.

The tree is thrifty and fairly vigorous, but a rather slender grower, with brownish-red bark on the young wood.

The specimen illustrated in Plate XXXIV was grown by Prof. C. C. Newman, in Rabun County, Ga.

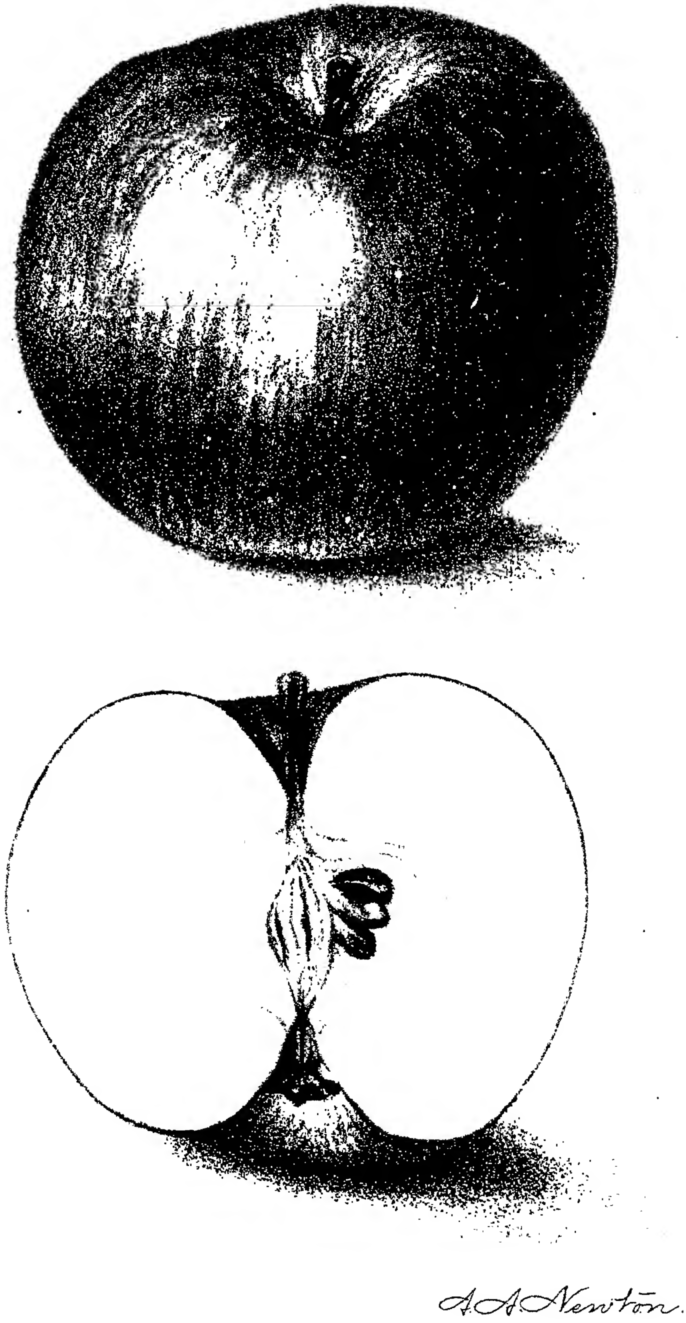
PAYNE PEACH.

SYNONYM: *Highland Beauty.*

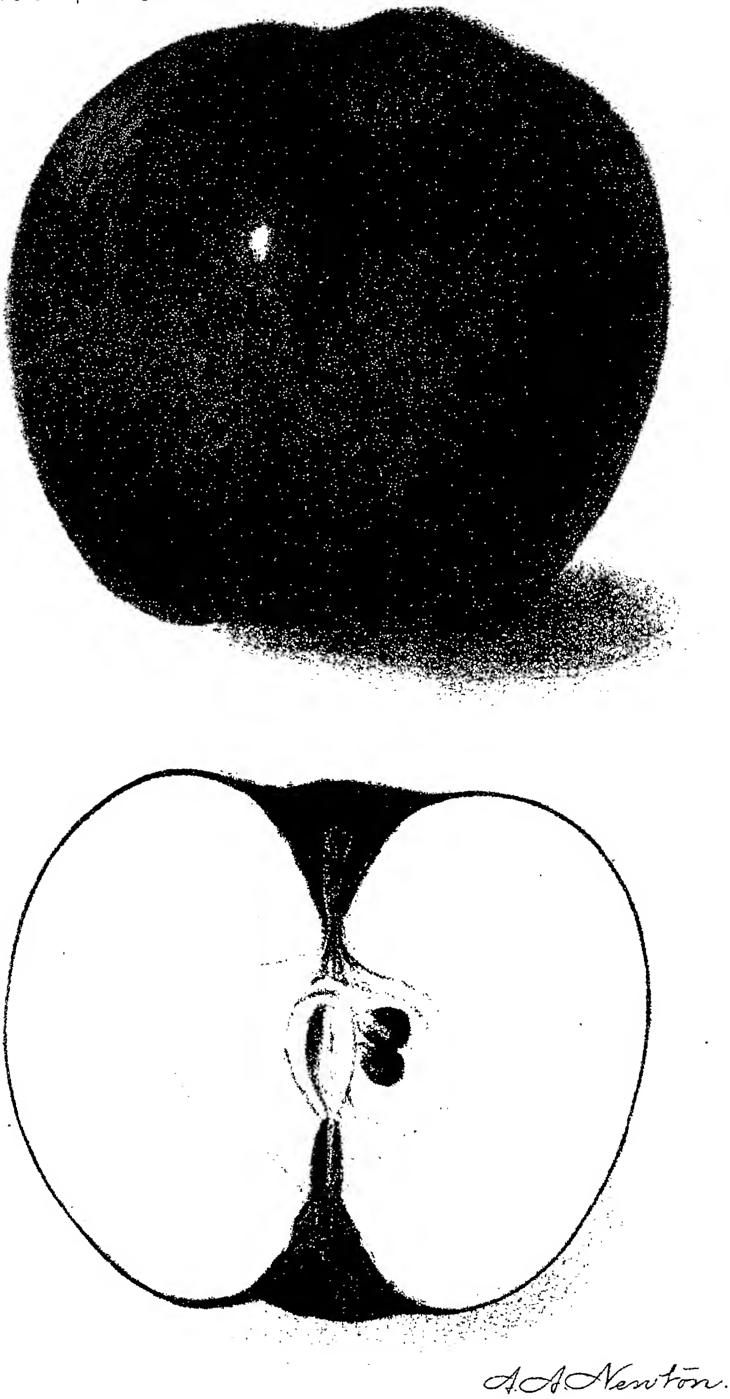
[PLATE XXXV.]

ORIGIN.

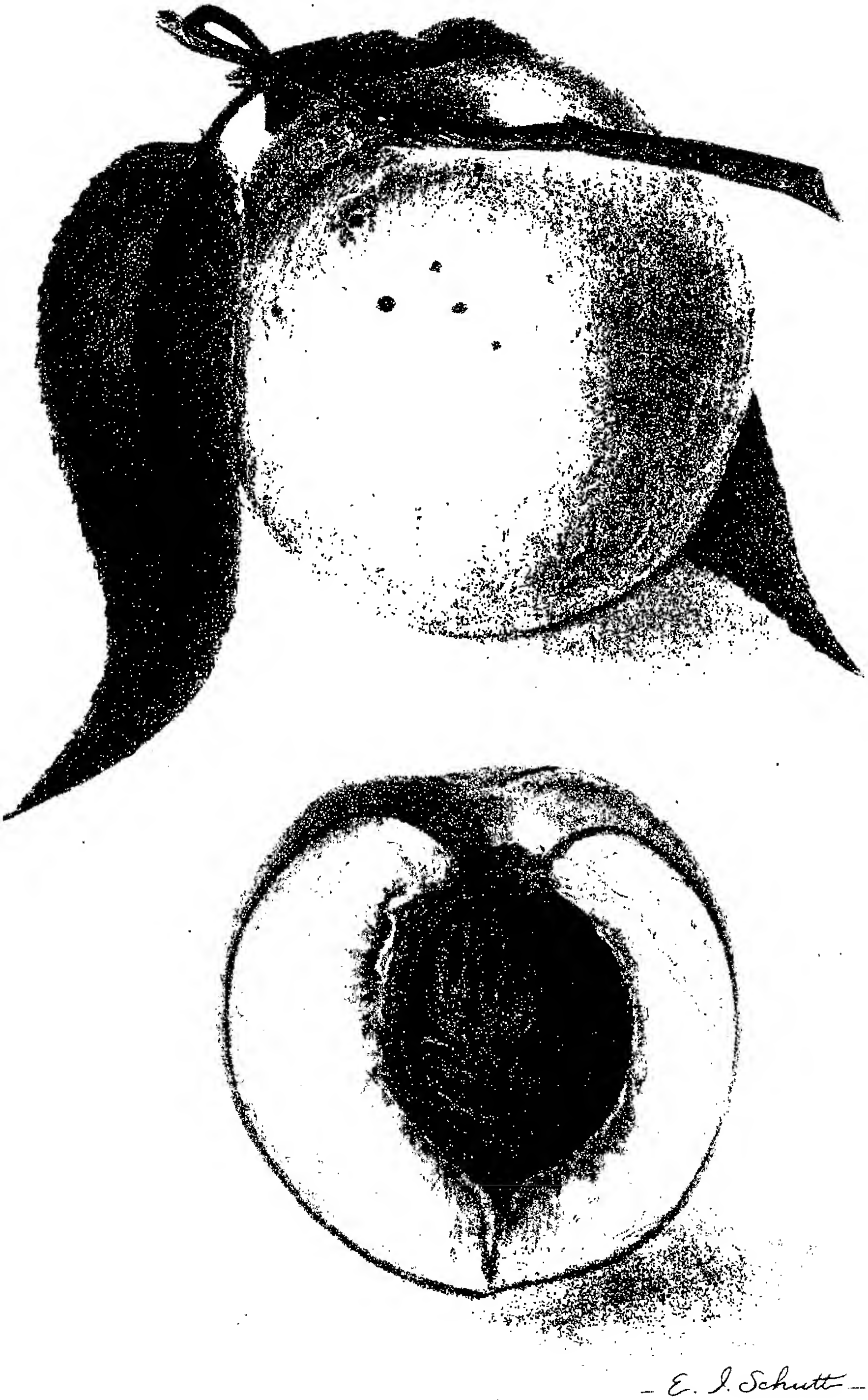
The original tree of this variety developed in 1901 as a sprout from the stock of a St. John peach tree broken off below the point of budding in the orchard of E. B. Payne & Sons, near Cloverdale, Barry County, Mich.



LOWRY APPLE.



KINNARD APPLE.



PAYNE PEACH.

HOOSIER RASPBERRY. — E. I. Schutt —

The tree that developed from this sprout bore its first crop when it was 3 years old. It was first called *Highland Beauty* in correspondence and when exhibited, but it does not appear to have been described under that name. It was described as Payne by Fletcher in 1910.[1]

It was first propagated in 1907 by E. B. Payne & Sons for their own planting.

DESCRIPTION.

Form roundish; size large; cavity regular, of medium size and depth with gradual slope and red markings; stem short, stout; suture shallow, extending from cavity to apex; apex a small point at termination of suture; surface soft, velvety; color yellow, blushed, and splashed with dark crimson; dots minute; down short, loose; skin thin, tenacious; flesh yellow, slightly stained at stone; texture melting, tender, juicy; stone oval, free, medium to large; flavor subacid, sprightly, slightly astringent; quality good to very good; tree vigorous, spreading, productive; leaves lanceolate, of medium size, with rather short, thick petioles; glands reniform; flowers small. Season last week of August and early September in the locality of its origin, ripening about a week in advance of St. John. The tree is productive and is considered hardier than most commercial varieties grown in that section.

This variety, though not yet tested in other than its original locality, is considered promising for test in northern peach-growing districts.

The specimen illustrated in Plate XXXV was grown by E. B. Payne & Sons, Cloverdale, Mich.

HOOSIER RASPBERRY.

[PLATE XXXVI.]

EARLY HISTORY.

This very promising blackcap raspberry originated on the farm of the late John W. Durm, 4 miles east of Pekin, Ind., about 1895, as the result of a definite effort to produce a variety that should be both very hardy and resistant to anthracnose. It is said to be a cross between Gregg and Mammoth Cluster.

In the development of this variety Mr. Durm and Mr. Alvia G. Gray (also of Pekin, Ind.) have been closely associated. They were mutually interested in producing hardy and disease-resistant varieties and from time to time planted large numbers of raspberry seeds with

[1] Varieties of Fruit Originated in Michigan, Special Bulletin No. 44, Michigan Agricultural College Experiment Station, August, 1910.

this end in view. The seed from which the Hoosier grew was planted by Mr. Durm about 1895. It was grown jointly by himself and Mr. Gray for a time for the purpose of testing it. After its merits had become apparent to them it was named "Hoosier" in 1898 by Mr. Durm, who, shortly before his death, turned it over to Mr. Gray to propagate for introduction and dissemination.

During 3 or 4 years following 1898, it was propagated in a limited way and the plants sold locally until 1902, when it was offered for sale to the trade, a price list issued that year by Mr. Gray containing the first published use of the name "Hoosier" for the variety.

It has thus far proved free from disease, vigorous, productive, and hardy, bearing good crops of fruit in some years under very unfavorable climatic conditions and when most other varieties in comparison failed.

DESCRIPTION.

Berries roundish, large to very large in size, borne in moderately loose clusters of 15 to 18 or more fruits and easily detached from the rather small receptacles; drupes large, glossy, black with a durable bluish bloom; pedicels slender, thorny; calyx small, pale green; flesh dark-purplish red, meaty, solid, firm, moderately juicy; seeds rather large and hard; flavor subacid with pleasant aroma; quality good.

The bush is a strong, vigorous grower and apparently possesses a rather unusual degree of hardiness. It is considered promising for the Middle Western States.

The cluster illustrated in Plate XXXVI was grown by A. G. Gray, Pekin, Ind.

DUGAT ORANGE.

[PLATE XXXVII.]

EARLY HISTORY.

The original Dugat orange tree is reported to have come as one among a hundred imported from Japan about the year 1880 as Unshiu (commonly known in this country as Satsuma) by Leonard Coates, then of Napa, Cal. About 1882 Col. W. S. Dugat obtained two of these orange trees from Mr. Coates's nursery and planted them on his place in Beeville, Tex. One of these trees died. After the other one (which later came to be known as the "Dugat") had been planted for several years, its habit of growth showed such striking peculiarities as to indicate that it was distinct from other sorts known in that section. Mr. G. Onderdonk, of Nursery, Tex., became interested in this tree because of its evident value for that section and has been largely instrumental in directing attention to it.[1]

[1] Letters and historical notes from G. Onderdonk, October 18 and December 13, 1904.

The dwarfish habit of growth of the tree gave the impression for several years that it, like the Unshiu trees imported at the same time, was on trifoliata stock. This was later found to be an error, although it has since been found to succeed well upon that stock. Correspondence with the importer and other efforts to identify the variety having failed to establish its identity, it gradually became known as the Dugat. It appears to have been first propagated commercially in this country about 1898 [1] by Mr. R. W. Holbert, Arcadia, Tex. Since that time it has been considerably disseminated through Texas and Florida nurseries.

DESCRIPTION.

Form roundish, very slightly ribbed; size medium to large; stem stout, placed in a small wrinkled cavity; apex slightly flattened; surface rather rough; oil cells large, indented; rind tenacious, moderately thick; segments commonly 12, irregular, rather loose, leaving an open center; seeds plump, variable in size, color, whitish; flesh yellowish translucent, tender; juice abundant, translucent; flavor sprightly subacid with pleasant bouquet; quality good. Season early, about the first of December in southern Texas. The crop is more uniform in size than Satsuma, and like other true oranges it keeps better than the Mandarin varieties.

The tree makes a dwarfish, compact growth and is practically thornless. For some time it was thought to be fully as hardy as Satsuma, but the experience of the past six years indicates that it is injured by cold sooner than the Satsuma on the trifoliata stock in Texas. The tree appears to have remarkable recuperative capacity, however, and when banked to protect the trunk from destruction by frost, quickly renews its top. Under such conditions it is reported to come into fruit again much more quickly than the Satsuma. It is also considered a more regular bearer than Satsuma. Its chief value thus far indicated is for the Texas coast country, where it is being considerably planted.

The specimen illustrated in Plate XXXVII was grown by Mrs. E. M. Dugat, Beeville, Tex.

FAMILY AVOCADO.

[PLATE XXXVIII.]

ORIGIN.

The original tree of the Family avocado was found by Prof. P. H. Rolfs, now director of the Florida Agricultural Experiment Station, on a place at Buena Vista near Miami, Fla., which came into his

[1] Letter from G. Onderdonk, January 12, 1911.

possession in 1902.[1] The age of the tree at that time is uncertain, but it was probably 5 or 6 years old. Its previous history is unknown.

It was first propagated for experimental purposes at the Subtropical Laboratory of the Bureau of Plant Industry at Miami in 1904, and has since been quite widely distributed for testing. Later, bud wood was furnished to a number of nurserymen, several of whom have propagated it commercially. The name "Family" was given it about the time that it was first propagated in 1904.

The original tree has failed to set fruit in but one year since 1902. It has the rather unusual habit of ripening its fruit, which is borne in clusters, over a period of 8 to 10 weeks, beginning 1 to 2 weeks later than the earliest varieties and continuing until the first fruits of the late sorts are ripe, or even later. It was because of this peculiarity that the name "Family" was selected for it by Professor Rolfs, it being well adapted to the supplying of fruit for family use; but it is less desirable for commercial purposes than the varieties that ripen their fruit more uniformly.

The original tree is still standing and is about 18 to 20 feet high. It is now rather spreading in habit of growth; when younger it was apparently more upright in growth, with branches somewhat inclined to droop.

DESCRIPTION.

Form obconical; size medium to large; cavity regular, small, shallow, with gradual slope and furrowed; stem stout; apex furrowed, russeted; surface undulating; color yellowish green, marbled, splashed and striped with purplish red; dots numerous, yellow, many indented; skin of medium thickness; flesh yellowish green, tender, buttery; seed roundish, large; flavor mild, pleasant; quality good to very good; season rather early to rather late.

This variety is especially valued for local use in southern Florida and is worthy of testing in California.

The specimen illustrated in Plate XXXVIII was grown by Prof. P. H. Rolfs at Miami, Fla.

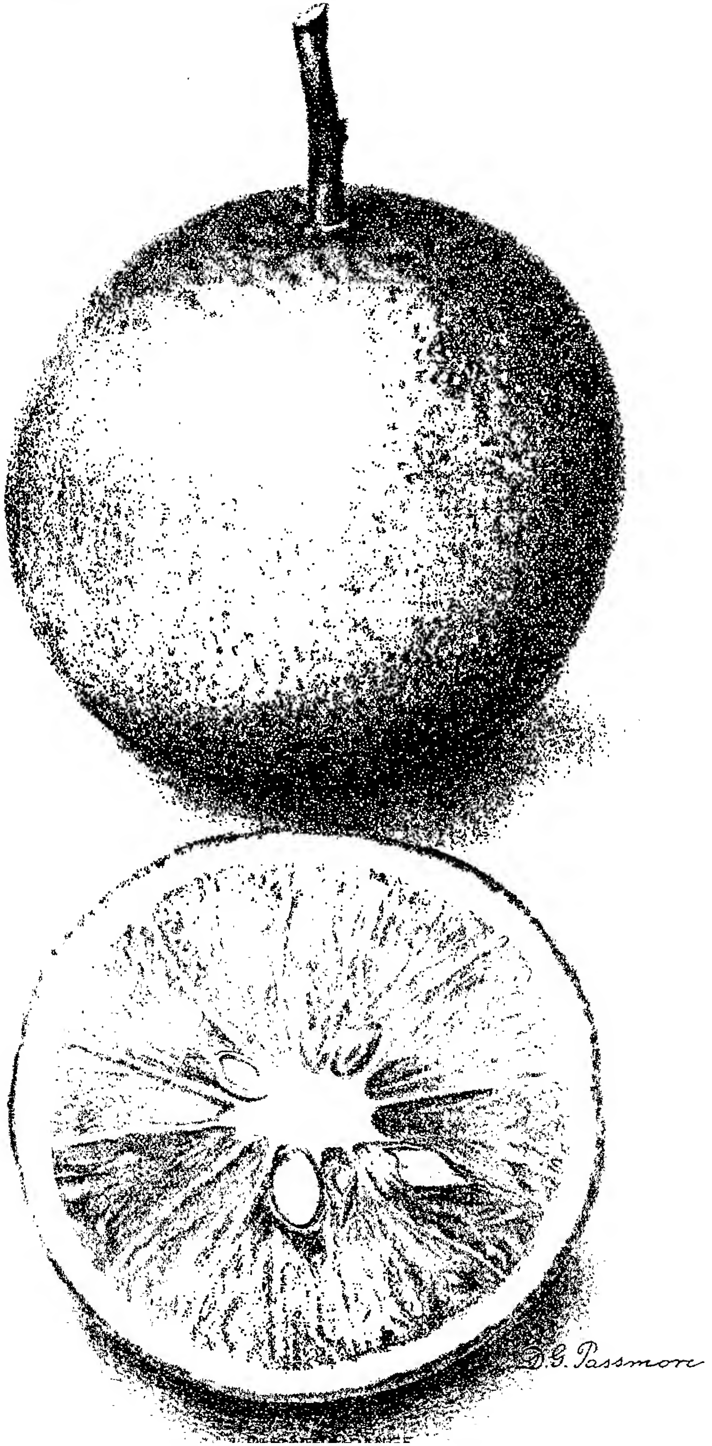
CECIL MANGO.

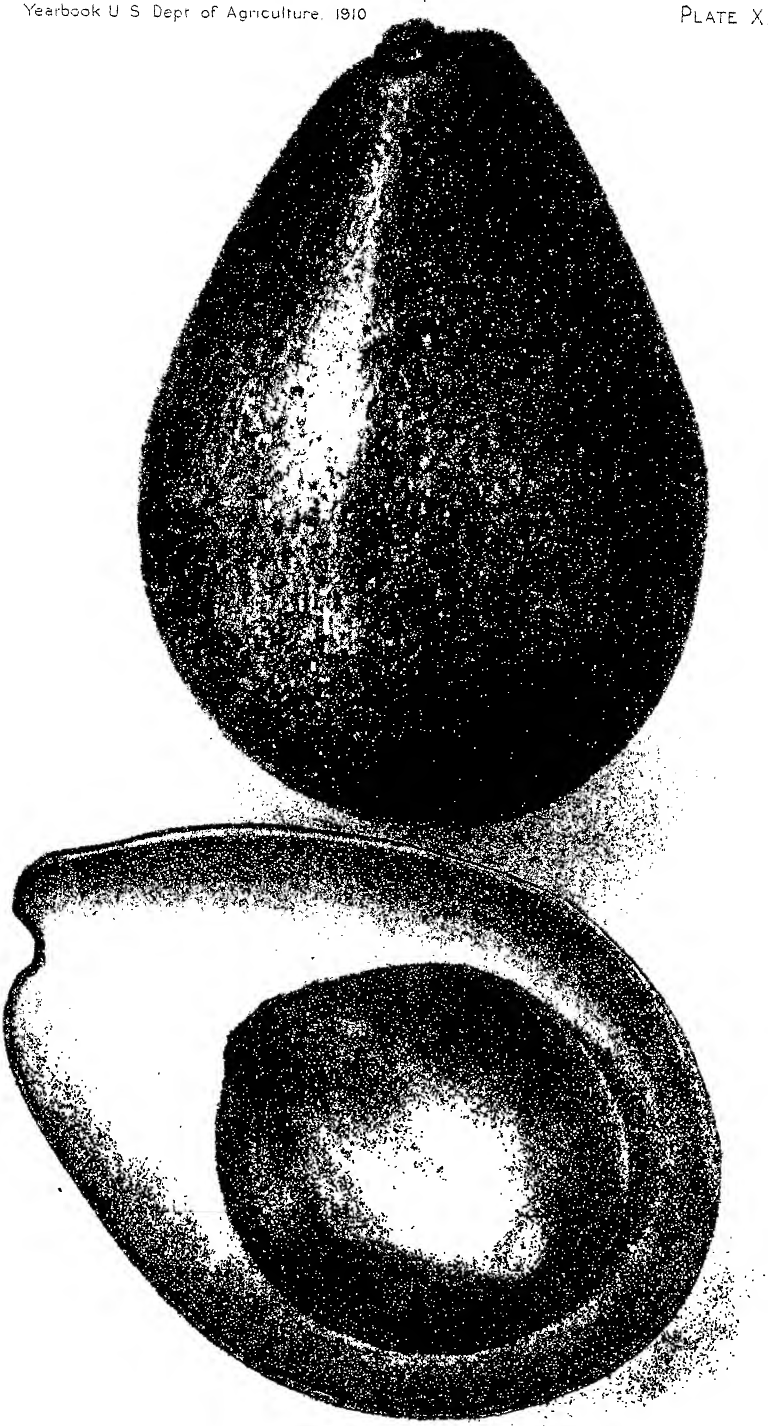
[PLATE XXXIX.]

EARLY HISTORY.

The interest in the mango in Florida has now continued for a sufficient time to begin to bring to light some good seedlings grown from seed of choice imported sorts. Choice new varieties may now be expected to appear in considerable numbers as trees in seedling orchards come into bearing sufficiently to demonstrate their distinctive

[1] Letter from P. H. Rolfs, November 1, 1910.

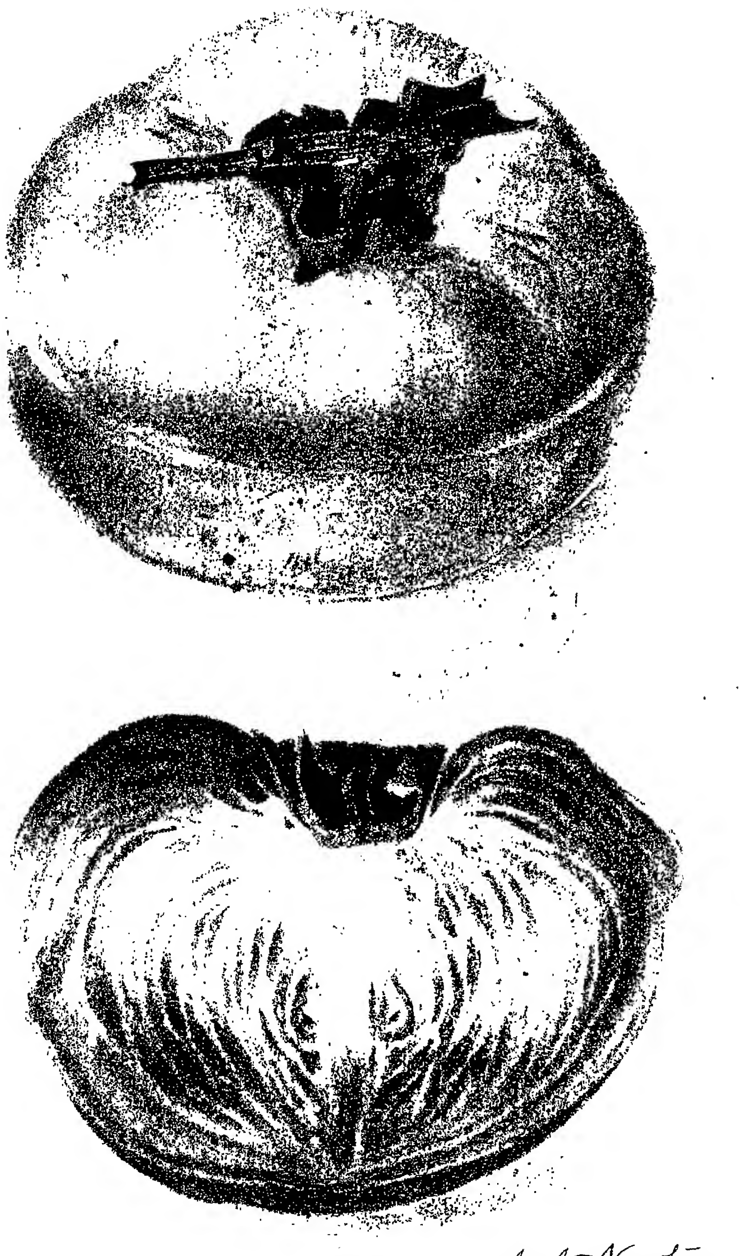

D.G. Passmore



FAMILY AVOCADO. — D. G. Passmore —

A. A. Newton.

CECIL MANGO.



TAMOPAN PERSIMMON.

characteristics. One of the most promising thus far is the Cecil, which originated at Miami, Fla.

In 1902[1] about 200 mango fruits of the "Philippine" type were received by Mr. S. A. Belcher of Miami, Fla., from some point in Cuba. The seeds of these fruits were planted in pots and later about 100 trees which grew therefrom were transplanted to permanent places on Mr. Belcher's homestead, now owned by Hickson Brothers, 2 miles west of Miami.

The tree to which later the name "Cecil" was given bore a few fruits for the first time when it was 5 years of age. It was named in the spring of 1908, after the unusual merits of the fruit had become apparent, the name having been first published in a local paper. Its commercial propagation was begun in 1910.

The tree is said to be a very vigorous grower, symmetrical in form, and a heavy bearer. The fruit begins to ripen at Miami about the first week in June.

DESCRIPTION.

Form oblong reniform, rather slender; size large; cavity regular, small, shallow, slope gradual; stem medium slender, fleshy where it joins the fruit; tip an inconspicuous beak, usually about half an inch from the longitudinal apex of the fruit; surface nearly smooth; color rich greenish or golden yellow, marbled lightly with brownish yellow; dots numerous, russet, sometimes subcutaneous, green or gray; bloom whitish; skin medium thick, tenacious; flesh yellow, tender, juicy with but very little fiber; seed thin, oblong, large; flavor sweet or mild subacid, rich, aromatic, pleasant; quality good to very good; season June to August at Miami, Fla.

Apparently adapted to Florida and worthy of testing in Porto Rico and Hawaii.

The specimen illustrated in Plate XXXIX was grown by Hickson Brothers, Miami, Fla.

TAMOPAN PERSIMMON.

[PLATE XL.]

HISTORICAL NOTES.

The introduction of the Japanese persimmon into the United States aroused widespread interest throughout the country on account of the precocity of the trees and the large size and great beauty of the fruit. For many years large importations of grafted trees from Japan were made by commercial nurseries, with the result that the varieties obtainable from Japanese nurseries were widely tested throughout

[1] Letters from Hickson Brothers, November 9 and 17, 1910.

the country. Much disappointment resulted when no sort was found among them sufficiently hardy to endure the winters north of the Gulf and South Atlantic States, except in specially sheltered locations. The fruits of most of them were found to retain their astringent flavor until they were too soft to ship or handle, so that their market value was considerably impaired.

Rather indefinite reports continued to come from travelers and missionaries of hardier large-fruited sorts grown in the interior of China that were superior in many respects to the Japanese varieties.

In an effort to obtain stock of such varieties, Hon. Charles Denby, then United States Minister to China, at the request of the Pomologist of the Department, in 1894 and again in 1895, procured and forwarded to the Department scions of sorts the fruit of which was of high repute in the Peking market. The scions were of two varieties, and Mr. Denby reported upon them at the time as follows:[1]

> These scions were procured at the village of Niuchuang, about 100 miles west of Peking. They were brought from this place because of the reputation it has for persimmons, being much resorted to by the Chinese themselves for scions. The trees from which they were cut grew on level ground at the foot of the hills. The soil was a yellowish loam, and the crops grown in the vicinity were Indian corn and tall millet. An ordinary specimen of the Kao Chuang variety examined by me was 9 inches in circumference, 2¼ inches thick, and weighed 6 ounces. Such fruit is sold at retail in Peking in immense quantities at 1 to 2 cash each (5 to 10 for 1 cent gold). The Mo pan variety measured 12 inches in circumference, 2½ inches thick, and weighed 11¾ ounces. This retailed at 3 to 5 cash each (2 to 3 for 1 cent gold).
>
> The fruit is orange yellow in color. It is sweet in flavor, recalling the taste of the American persimmon without its astringent effect. It is eaten raw. It ripens without frost.

Unfortunately the several lots of scions sent at that time, though packed and forwarded with great care, failed to survive the journey, arriving too dry and lifeless to propagate. Persimmon seeds sent by Minister Denby at the same time germinated freely, and several hundred trees were grown from them for distribution, but all proved to be of the small-fruited *Diospyros lotus*, which is used in the Orient as a stock for the more highly esteemed varieties.

After this unsuccessful effort no systematic attempt to obtain the large varieties appears to have been made until 1905, when Mr. Frank N. Meyer, agricultural explorer in the Office of Foreign Seed and Plant Introduction of the Bureau of Plant Industry, sent from the Ming Tombs Valley, west of Peking, several lots of scions of a variety evidently closely similar to, if not identical with, the "Mo pan" previously obtained by Minister Denby. This sort, which Mr. Meyer

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[1] Letter of Hon. Charles Denby to Secretary of Agriculture, dated Peking, November 19, 1895.

later found growing in several localities in China, he states is known as "Ta mo pan shi tze," signifying "big grindstone persimmon," on account of its large size and peculiar flattened form. Mr. Meyer states:[1]

The fruit of this particular variety has a bright orange-red color, grows to a large size, measuring 3 to 5 inches in diameter, and sometimes weighs more than a pound. It is perfectly seedless, is not astringent, and can be eaten even when green and hard. It stands shipping remarkably well. The fruit is of a peculiar shape, having an equatorial constriction, which makes it look as if two fruits had been joined, or, to use a more terse expression, as if somebody had sat upon it. The trees are very thrifty growers when once thoroughly established. They reach a height of 30 to 50 feet, and though the young branches are very erect, the older ones bend down a good deal because of the great weight of the fruit. The trees seem to bear very heavy crops in some years, while in other years the harvest is small. A drawback of a large crop is that the great weight of the fruit causes the large limbs to snap off unless they are propped or tied up. This, therefore, has to be done regularly. It seems that when the trees of this variety reach the age of 40 or 50 years they begin to decline in vigor; still, here and there old specimens may be seen that are near the century mark.

These large persimmons are mostly used when fresh. Foreigners in China are fond of eating them with a spoon, and after being kept in a cool place for some hours the fruit is very refreshing. They can be eaten while still hard, like apples. By careful handling and by keeping the persimmons at a low temperature they can be preserved for several months. To keep them through the winter the Chinese pile them in heaps, let them freeze thoroughly, and keep them frozen until they are needed. When wanted, they are simply put into a vessel with cold water to be thawed slowly, and then they are as good as when freshly picked. They can also be eaten when slightly frozen, like sherbet, and occasionally they are quite acceptable in that condition.

Scions and young trees of this variety have been experimentally distributed by the Office of Foreign Seed and Plant Introduction under the name Tamopan (S. P. I. No. 16921), and the variety has been sufficiently fruited to indicate its high promise. The fact that the fruit loses its astringence before softening gives it special value, and its unique form constitutes an effective identification mark by which it can be readily recognized in market.

DESCRIPTION.

Form oblate to roundish oblate with a conspicuous equatorial constriction which distinguishes it from other types; size large to very large; cavity regular, large, deep, slope gradual, marked with four furrows and russeted; stem moderately stout; calyx segments of medium size, reflexed around stem; apex depressed, terminating in

[1] Agricultural Explorations in the Fruit and Nut Orchards of China, Bulletin 204, Bureau of Plant Industry, pp. 11–12.

a small point located in the intersection of the sutures which divide the fruit into well-defined quarters; surface smooth; color rich yellow to orange yellow; dots very minute; skin medium thick, tenacious, covered with transient, whitish bloom; flesh yellowish, translucent; texture very tender, melting, juicy; seeds undeveloped in specimens examined; flavor sweet, losing astringence before softening; quality very good. The tree is a strong, vigorous grower, showing good evidence of productiveness.

The fruiting of this variety in America has thus far been restricted to North Carolina and Florida. Its cold endurance is therefore not yet determined, but it is considered promising for experimental planting in the territory south of the Potomac, Ohio, and Missouri rivers and on the Pacific coast. Its northern source in China suggests the possibility of sufficient hardiness to thrive as far north as our native persimmon succeeds.

The specimen illustrated in Plate XL was grown by the Glen St. Mary Nurseries Co., Glen St. Mary, Fla.

THE PRECOOLING OF FRUIT.

By A. V. Stubenrauch, *Expert in Charge of Fruit Transportation and Storage Investigations*, and S. J. Dennis, *Expert in Refrigeration, Bureau of Plant Industry.*

INTRODUCTION.

The term "precooling" has been applied to the rapid and prompt cooling of fruit or other produce before it is shipped or stored. Ice and salt or mechanical refrigeration are usually employed as the cooling agents. The object of precooling is to reduce the temperature of the fruit as quickly as possible to a point where ripening will be retarded and decay and deterioration prevented.

Probably no process of fruit handling has so rapidly attracted widespread interest within so short a time after it was first suggested as has this comparatively new idea in preparing fruit for shipment over long distances.

The purpose of this paper is to present in a rather conservative and concise form the progress and results of the investigations which have been made by the Bureau of Plant Industry and to give the exact status of the process as far as it has been applied under commercial conditions.

Many problems connected with the rapid reduction of the temperature of fruit remain to be solved. It is not yet certain just what system of cooling is preferable, whether the cooling should be accomplished before the fruit is loaded in the cars, or whether cooling after loading is most advantageous. Careful and comprehensive study of all phases of the subject and a long series of tests will be required before the problems are fully solved.

Precooling of fruit has already received commercial application. A number of plants have been erected and are in operation in California, and many more are projected in various parts of the country. Some of these plants, operated by associations of growers or shippers, precool the fruit before it is loaded; some, constructed by transportation companies and operated in connection with the refrigerator-car service, are car-cooling plants and accomplish the precooling after the fruit has been loaded and delivered to the railroads.

The ideal system of precooling for all conditions has not yet been found. While the process has not yet wholly passed the experimental stage, its importance as a means of promoting the safe trans-

portation of fruits for great distances has long been fully recognized and its use will be extended as rapidly as the principles can be worked out and their practical application under different conditions and to different crops demonstrated.

THE REASONS FOR PRECOOLING.

During the maturing of a normal fruit on the tree certain chemical and physiological changes are constantly taking place within the fruit itself. These changes, which result in the acquirement of quality and flavor, constitute the ripening processes. After a certain point is reached the fruit becomes overripe, quality and flavor are lost, and deterioration progresses until eventually the fruit is destroyed by fungous decay or fermentation, or through destructive physiological changes.

A fruit may be considered as a living organism which has a definite span of existence, the length of this span depending upon the conditions surrounding the organism. The most important factor which modifies this span of life is temperature. When the fruit is removed from the parent plant the life processes constituting ripening are materially hastened and the life span is greatly shortened if the fruit is allowed to remain warm for any considerable length of time. Hence, the importance of reducing the temperature as promptly and rapidly as possible after the fruit is picked.

The length of the life span differs with the character of the fruit. It is shortest in the soft fruits, such as berries, cherries, peaches, apricots, plums, and most pears, and longest for the harder fruits—citrus fruits and apples. It varies with different varieties within the same group of fruits. Some varieties of apples, for example, keep longer than others; lemons keep longer than oranges. The importance of quick and prompt cooling—precooling—then, is greatest in the case of the soft fruits and least for the harder fruits. Experience so far confirms this rule.

Aside from the breaking down from overripeness, fruits are subject to premature decay due to the attacks of various fungi. The most common forms of these fungi, however, have not the power to penetrate the sound, unbroken skin of a healthy, normal fruit. Most of the decay occurring in fruits in transit and storage starts at injuries and breaks in the skin, caused almost entirely by rough handling in preparing the fruit for market, either in picking, grading, hauling, or packing. Wounds, bruises, scratches, or abrasions of any kind allow the organism of decay to gain entrance. Other fungi which are not dependent upon injuries to start, attack fruits in transit and storage; but these forms of decay are much less prevalent.

The germination of the decay spores, which are analogous to the seeds of higher plants, is dependent upon proper moisture and temperature conditions. Germination does not take place while the fruit is perfectly dry or when the temperature is low. After the spores have germinated, however, and the decay has started within the fruit, even as low a temperature as 32° F. will not wholly check it. Growth of the mold is only retarded and the decay continues slowly to develop.

The prompt and rapid reduction of the temperature below the point where the decay spores will germinate prevents the development of the disease, and even fruit which has been rendered extremely susceptible through mechanical injury of some kind can be transported with only slight loss from decay when promptly cooled. It is not advisable, however, to depend upon precooling to prevent decay following injuries. The spores of the fungi are not destroyed by the low temperature. They merely remain dormant until conditions are favorable for their germination and growth. These conditions usually exist as soon as the fruit is unloaded from the cars, especially in humid, hot weather. The loss from decay is thus transferred to the market end, and such fruit will soon gain a reputation for poor market-holding quality and will be discounted accordingly. It is just as important that fruit remain in sound condition long enough after arrival in market to be sold and consumed as it is to get it to market sound. Precooling may not be legitimately substituted for careful handling in preparing fruit for shipment.

REVIEW OF PRECOOLING INVESTIGATIONS.

The precooling investigations of the Bureau of Plant Industry were begun in 1904, when, so far as is known, the first application of this principle to the handling of fruit was made by Powell, in Georgia, in connection with a study of the causes of decay in peaches during transit from the Southeastern States to northern markets. These investigations have been continued and extended as rapidly as the means at command would permit, and it will be necessary to continue the work for a number of years, as many problems remain unsolved. The work so far has included the cooling of peaches, oranges, and table grapes in California, and additional work on peaches in Georgia.

In the first peach work in Georgia and California (1904 and 1905) the precooling was done in ordinary refrigerator cars. The bunkers were filled with ice and salt and the fruit was stacked openly, half a carload being cooled at a time to allow free circulation of the cold air. These experiments were therefore of the "warehouse" type of precooling, which insures the thorough cooling of every package before it is loaded for shipment.

For the orange and grape work and for the later peach work in Georgia special equipment, using mechanical refrigeration, was provided. Most of the orange work was done in connection with commercial cold-storage plants, including cooling in refrigerated rooms before loading and by blowing cold air through the cars after loading.

Later, in 1908, a special, portable, experimental precooling plant was added to the Bureau equipment, which makes the work largely independent of commercial plants and renders it possible to carry on precooling investigations at any point having railroad facilities. The outfit consists of a 12-ton ammonia compression system installed in one end of a specially constructed freight car. The other end of the car is heavily insulated, and forms a coil room containing 5,000 feet of 1¼-inch ammonia expansion piping. Engines, fans, pumps, condensers, dynamos, and electric motors are included, and provision is made for accurately measuring the temperature, refrigeration, power, and other factors, so that full data can be obtained. The cooling is accomplished by circulating air over the piping in the coil room by means of a 45-inch exhaust fan of the centrifugal type, which forces the cold air through removable insulated 20-inch pipes to an adjacent car or building. Plate XLI, figures 1 and 2, show this plant in operation at Lodi, Cal. Since 1908 all precooling investigations of the Bureau have been made with this portable outfit.

The first car precooling of oranges was done by circulating cold air through the cars from a commercial cold-storage plant by means of fans and connecting tubes or ducts, provision being made to reverse the air current when necessary. During 1909 the car precooling of oranges was accomplished by means of the portable plant.

The cooling of oranges before loading was done in ordinary cold-storage rooms provided with a liberal amount of piping. The orange work is the most comprehensive of any precooling work done with fruits. The car-precooling work with this fruit included tests on 44 cars; in the warehouse storage-room cooling, 30 carloads were handled. The results of this work are corroborative and definite and show that to accomplish the precooling with any reasonable degree of rapidity after the fruit is loaded in cars requires the use of very large volumes of very cold air. The difficulty of cooling fruit wrapped in paper and tightly packed in boxes was strikingly shown, and where the time element is important heavy machinery and power must be provided. This work also brought out the impracticability of cooling all parts of the car equally; there were frequently differences of more than 20 degrees between the coldest and the warmest fruit in the same car after a run of 18 to 24 hours. It therefore becomes necessary in car precooling to chill some of the boxes as nearly to the freezing point as possible and then to depend upon an equaliza-

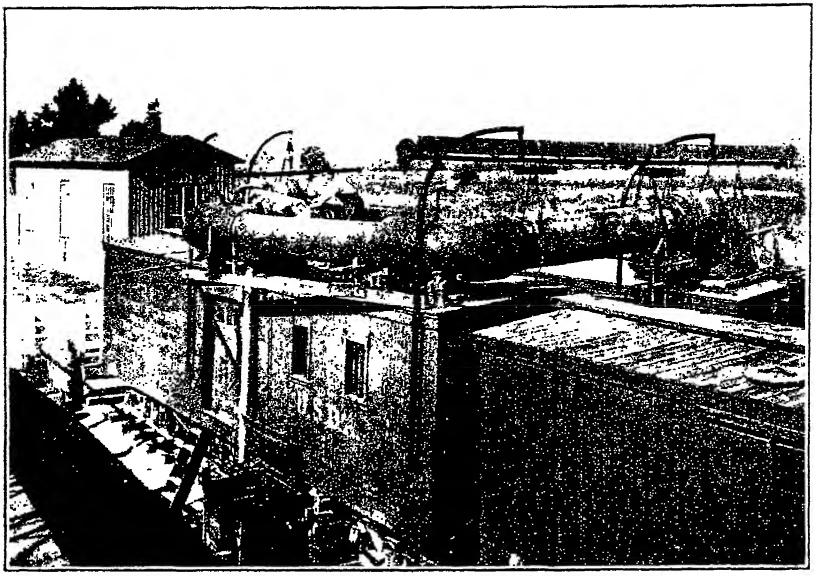

FIG. 1.—GENERAL VIEW OF PRECOOLING CAR (AT THE LEFT) CONTAINING THE MACHINERY AND COILS FOR COOLING THE AIR WHICH IS CIRCULATED THROUGH THE AIR PIPES SUSPENDED ABOVE TO THE CAR OF FRUIT BEYOND.

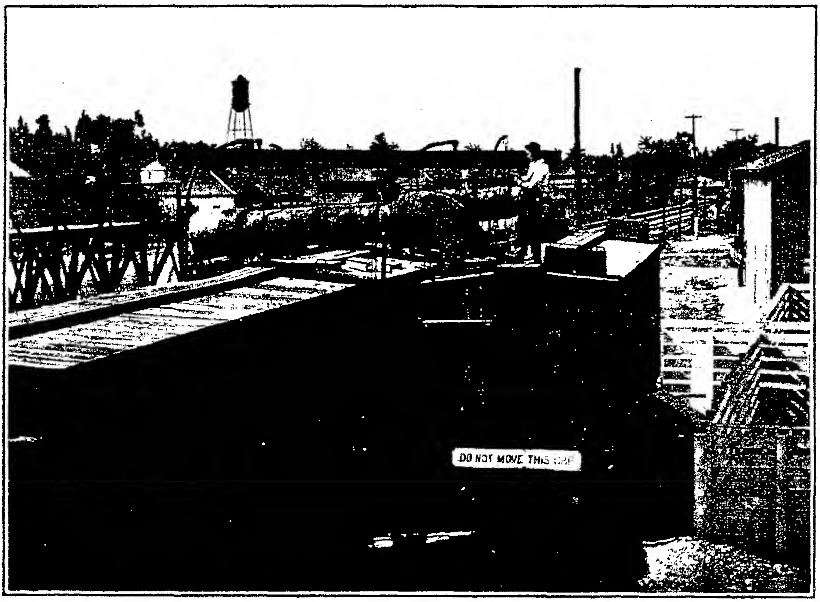

FIG. 2.—VIEW SHOWING THE COLD-AIR PIPES CONNECTED TO A REFRIGERATOR CAR LOADED WITH FRUIT.

THE PORTABLE EXPERIMENTAL PRECOOLING PLANT OF THE U. S. DEPARTMENT OF AGRICULTURE, OPERATING ON TABLE GRAPES AT LODI, CAL., 1910.

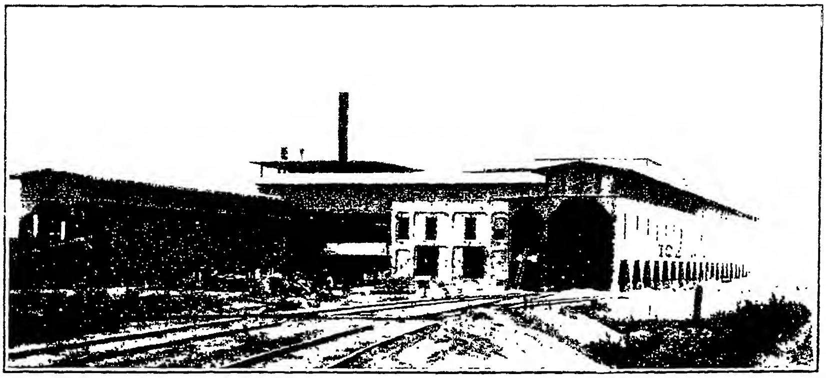

FIG. 1.—GENERAL VIEW OF PLANT FROM THE EAST SIDE, SHOWING PRECOOLING BUILDING AND COVERED AIR DUCTS LEADING FROM IT TO THE CAR SHEDS ON EITHER SIDE.

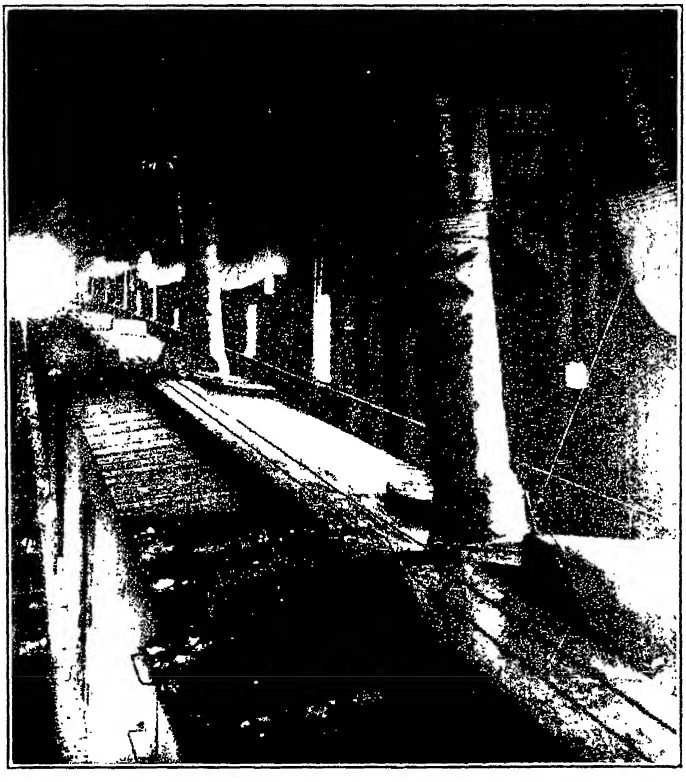

FIG. 2.—INTERIOR OF PRECOOLING SHED, SHOWING FLEXIBLE AIR-PIPE CONNECTIONS FOR WITHDRAWING AIR FROM CARS.

RAILROAD CAR-PRECOOLING AND ICING PLANT AT COLTON, CAL., BUILT AND OPERATED BY ONE OF THE TRANSCONTINENTAL RAILROAD LINES.

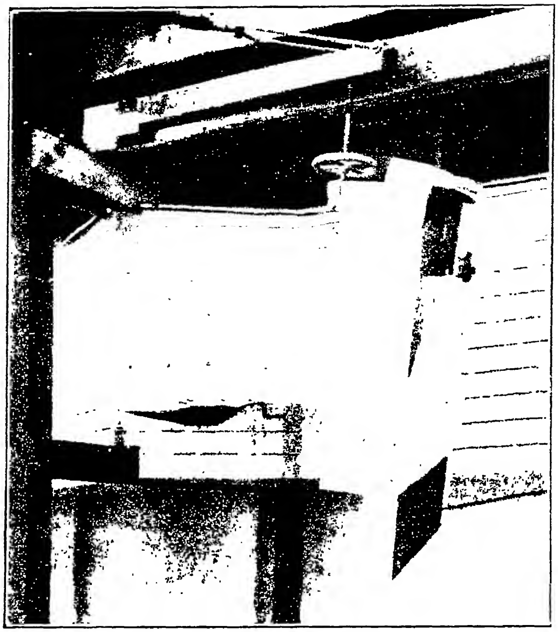

FIG. 1.—ADJUSTABLE DOOR CONNECTION FOR BLOWING COLD AIR INTO DOORWAYS OF CARS, SHOWING CURVED BAFFLE PLATES FOR DISTRIBUTING AIR INTO UPPER PARTS OF CARS.

[In use at the car-precooling and icing plant at Colton, Cal.]

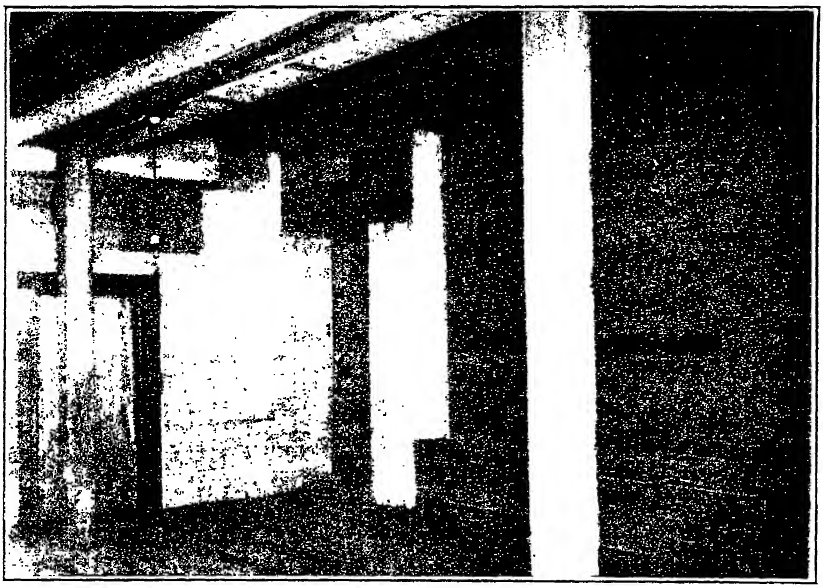

FIG. 2.—PRECOOLING ROOM IN AN ORANGE-PACKING HOUSE AT UPLAND, CAL., SHOWING AIR DUCTS FOR DISTRIBUTING COLD AIR THROUGH PERFORATED FALSE FLOOR AND CEILING.

[Cold air forced into the room through holes in the floor is withdrawn through holes in the ceiling.]

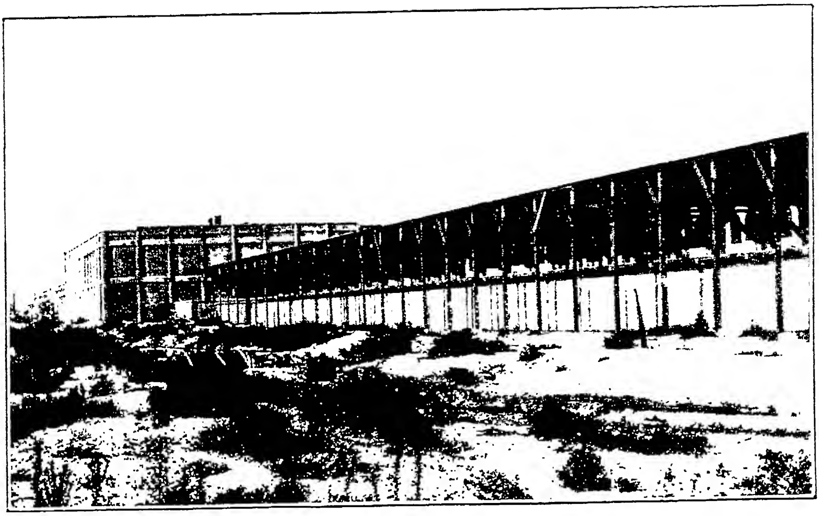

FIG. 1.—GENERAL VIEW OF ICE-STORAGE BUILDING AND PRECOOLING SHED.

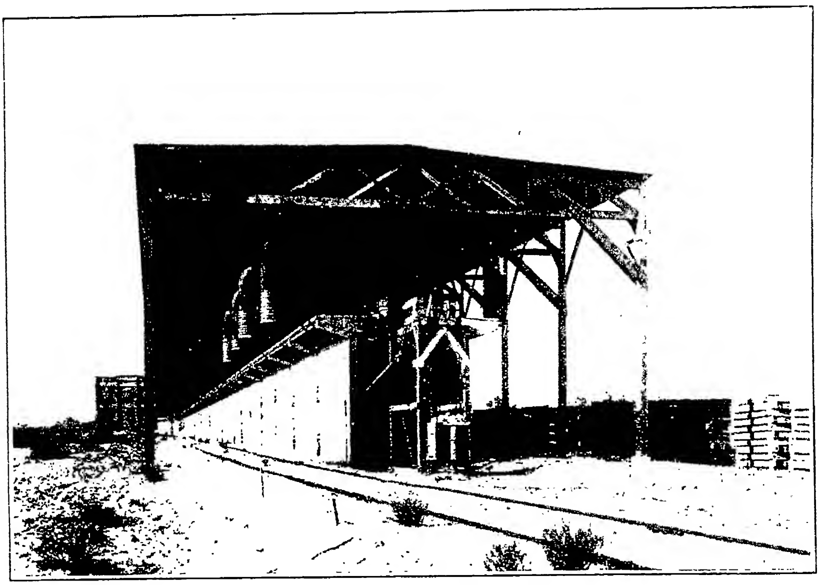

FIG. 2.—END VIEW OF PRECOOLING SHED.

[Under the icing platform, between the two tracks, are the cold-air supply and return ducts whereby cold air is circulated through the cars by means of the adjustable swinging air pipes overhead.]

CAR-PRECOOLING AND ICING PLANT AT SAN BERNARDINO, CAL.

FIG. 1.—CANVAS HOODS USED AT AN ORANGE-PRECOOLING PLANT AT EAST HIGHLANDS, CAL., TO PREVENT LOSS OF COLD AIR IN LOADING PRECOOLED FRUIT INTO CARS.

[When in use, the hoods are extended against the sides of the cars; at other times the hoods are folded back against the building.]

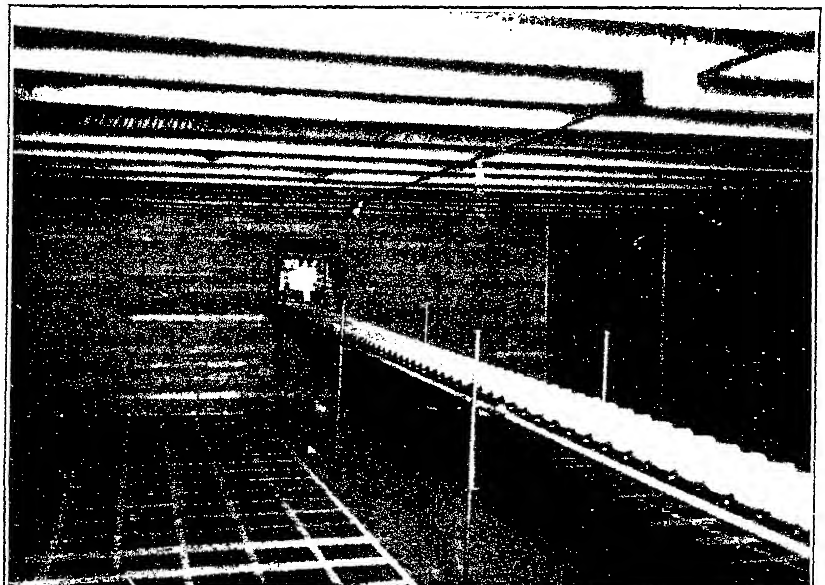

FIG. 2.—PRECOOLING ROOM IN AN ORANGE-PACKING HOUSE AT EAST HIGHLANDS, CAL., SHOWING ROLLER CONVEYOR FOR CARRYING THE PACKED BOXES OF FRUIT INTO THE PRECOOLING ROOM.

[The marking on the floor is intended to facilitate regularity in stacking so as to provide proper air-circulation spaces between the boxes.]

tion of the fruit temperatures to bring the carload as a whole down to the desired point. It was found that the wrapped and tightly packed oranges can be exposed for several hours to a direct blast of air many degrees below the freezing point of the fruit without danger of freezing.

In the storage rooms the time element is not so important. From 36 to 48 hours, depending upon the initial temperature of the fruit and the efficiency and capacity of the refrigeration, were required to cool the fruit to the temperature which would be maintained by the iced refrigerator cars en route.

As already mentioned, the peach precooling work in Georgia in 1904 and the California work of 1905 were of the "warehouse" type of cooling. This work was fundamental, and all subsequent investigations along these lines were based upon the results there obtained. The possibility of safely transporting fruit which had been well ripened on the tree and preserving its quality and flavor was fully demonstrated. In addition, the loss from decay was materially reduced in the precooled cars. The equalization of temperature conditions in the refrigerator cars was strikingly shown. There was far less difference between the top and bottom tiers of the load than is usual under ordinary icing methods.

The work done with the portable plant in Georgia in 1910 was of the car-cooling type. Fourteen cars of peaches were precooled after loading. Much more rapid cooling was accomplished than was possible with oranges, as the Georgia peach is packed in 6-basket slatted carriers without wrapping. The average initial fruit temperature was 73.9° F.; an average reduction of 21.1 degrees was accomplished, the time of running averaging 5 hours 35 minues. Insufficient water supply prevented the operation of the plant to its full capacity; otherwise better results would undoubtedly have been possible.

The average decay found in the "extra fancy" fruit on arrival at New York was 7 per cent in both the fourth and bottom tiers in precooled, as compared with 19.45 and 8.2 per cent on the fourth and bottom tiers, respectively, of nonprecooled cars. In the "fancy" grade the decay averaged 5.8 and 2.9 per cent, respectively, in the precooled fourth and bottom tiers, and 14.1 and 6.2 per cent for the same tiers, respectively, in nonprecooled shipments. The extra fancy grade was larger and softer fruit and received more squeezing and bruising in handling and packing; hence the larger percentages of decay. The equalizing effects of precooling and the avoidance of excessive decay frequently occurring in fruit loaded on the upper tiers are thus strikingly shown.

The California table-grape precooling of 1909 and 1910 was of the car-cooling type after loading. The results of this work are rather indeterminate and no satisfactory conclusions can be drawn. The

precooling was effective in checking the decay which ordinarily follows injuries to the grape berries due to careless handling, but it proved less effective and in some shipments failed to prevent the development of other forms of decay occurring after wet weather. The results of the two seasons are corroborative and show that some problems in the precooling of grapes in cars still remain which are thus far not fully understood. The question arises whether the unavoidable inequality of cooling of the grapes in the cars is responsible for the inconsistent results, and if this is the case serious doubt may be thrown on the practicability of cooling this class of fruit after loading.

TYPES OF PRECOOLING PLANTS.

METHODS AND CONDITIONS.

The precooling plants thus far in commercial use are of two different types. In one, the cooling is accomplished before loading in cars; in the other, after loading by forcing cold air through the cars. Plants for cooling before loading consist of insulated rooms provided with means for thorough cooling and do not differ greatly from ordinary cold-storage warehouses; they have been termed "warehouse precooling plants" to distinguish them from the car-precooling type.

The car-precooling plant must be equipped with refrigerating machinery of relatively large capacity in order to accomplish the cooling as rapidly as possible without danger of unduly chilling any portion of the contents of the cars. The construction of numerous plants of this type at points where but few cars are to be cooled is impracticable on account of the relative cost of the machinery required and the short time each day that this machinery can be utilized. If plants are not located at all principal shipping points the delay and additional cost of switching cars to the plants are disadvantages. To avoid extra switching, the cooling and icing of the cars must be accomplished at the same plant. For these reasons the cooling of fruit in cars can be performed to advantage only by the transportation companies in connection with the refrigerator-car service.

With refrigerator cars as at present constructed and with the arrangement for circulating the cold air through the cars at the cooling plants so far erected, there is unavoidably a very considerable leakage of cold air and loss of refrigeration. The colder the air the greater the cost of producing it and the larger the loss of refrigeration by leakage. The jolting and racking of the cars in service tends to open crevices and seams, so that except when new they are far from being tight enough to prevent a considerable loss of air, with only very slight air pressures.

To precool fruit quickly in cars and to make up the unavoidable losses of refrigeration due to the leakage of the cold air requires a considerably larger and more expensive cooling plant than is necessary to cool the same quantity of fruit more slowly in a well-constructed warehouse room. In the warehouse there is less necessity for hastening the cooling; the air need not be so cold nor circulated so rapidly; the room can be more tightly constructed and better insulated than a refrigerator car; the loss of cold air and refrigeration is not so great; and the cooling is accomplished at less cost. The warehouse type of plant is the only practicable one for the shipper who desires to precool his own fruit.

The types of packages and methods of packing at present in use do not admit of a sufficient circulation of air through the packed fruit to cool it at all rapidly. Thorough cooling is necessarily somewhat slow unless very cold air is used. Rapid cooling of packed fruit will necessarily be very unequal, the fruit in the outer portions of the packages cooling very much more quickly than that in the interior. Too long an exposure to extremely cold air will result in freezing the outer fruit before that in the interior is thoroughly cooled. On the other hand, those who have not made actual tests of the temperature of the fruit under such conditions will probably be surprised at the length of time that warm fruit may be exposed to extremely cold air before becoming unduly chilled. The temperature of the air surrounding the fruit package does not indicate at all the temperature of the fruit itself unless it has been exposed to the air temperature for many hours. This is particularly true of the fruit in the centers of tightly packed boxes or crates and of fruit wrapped in paper. The blowing of cold air over fruit has very little or no effect in preserving it unless continued until the temperature of the fruit itself is actually lowered. This fact has not been entirely appreciated in some of the commercial precooling work so far performed. It has been assumed apparently that because the fruit packages have been exposed for an hour or more to moderately cold air the fruit is therefore cold, which may be far from being true.

CAR-PRECOOLING PLANTS.

Three plants of the car-precooling type have been erected in California. All of these combine ice manufacturing and car icing with the precooling and are operated by railway companies in connection with the refrigerator-car service. The plants are located at important junction points connecting directly with the main lines to the East. Long sheds protect the cars, cold-air ducts, and icing platforms from the direct heat of the sun. The cars are iced immediately after precooling without additional switching.

PRECOOLING PLANTS AT ROSEVILLE AND COLTON, CAL.

The precooling plants at Roseville and Colton, Cal., are nearly alike in size and arrangement, having been installed by the same company. Plate XLII, figure 1, shows a general view of the plant at Colton. Large exhaust fans force the air through an insulated coil room containing many thousand feet of ammonia expansion or cooling coils into the cold-air duct which extends alongside the precooling track under the icing platform. Flexible branch pipes connecting with the cold-air duct carry the air into the cars through false or temporary doors which are set into the car doorways. Plate XLIII, figure 1, shows the adjustable door connection as it appears when disconnected and swung aside. After passing through the cars the air is withdrawn through the ice hatches at both ends, which are connected by means of flexible branch pipes to the return-air duct located above the cars. (Pl. XLII, fig. 2.) When desired, an intermittent system of circulation can be put into operation. Under this system the air is drawn from the cars by the fans and discharged alternately into the coil room and the outside air, the discharge in each case continuing for a few seconds. During the interval of the discharge into the outside air the cold-air supply is cut off, while the fans continue to exhaust from the cars, and the air pressure in the cars is thus very slightly reduced. The intermittent circulation is employed for a few minutes at a time several times during the cooling of a car. It is claimed that this intermittent exhaust tends to remove from the cars and air ducts the exhalations from the fruit which are supposed to promote decay if allowed to remain. It is claimed that rapidity of cooling is promoted by the alternate slight variations of air pressure in the cars, which are supposed to assist in working out the warm air from the interior portions of the fruit packages.

The Roseville plant accommodates 20 cars at one setting. The refrigerating machinery, which can be employed for either ice making or precooling, has a capacity of 260 tons (i. e., equal to that furnished by 260 tons of ice) per 24 hours. The Colton plant is provided with refrigerating machinery of the same capacity, but has two precooling sheds, as shown in Plate XLII, figure 1. Each shed accommodates 20 cars at one setting and is intended to be used alternately with the other, the cold-air blast being delivered to either shed, as required, while the cars in one are being iced and switched.

PRECOOLING PLANT AT SAN BERNARDINO, CAL.

The precooling plant at San Bernardino, Cal., includes two adjacent tracks, as shown in Plate XLIV, figure 1. Sixteen cars on each

track can be precooled at one time. A concrete structure between the tracks incloses both the cold-air supply and return ducts and supports the icing platform. The branch pipes connecting with the ice hatches at both ends of the car arch over from the main air ducts to the tops of the cars. These connecting pipes are insulated and are in two sections, swiveled together, so that the free end of the outer section may be swung to any position. A bellows-like section on the free end admits of adjustment for cars of any height (Pl. XLIV, fig. 2).

The particular features of this plant are those relating to the control of the air pressure in the ducts according to a system designed to minimize the effect of air leakage from the cars. Two sets of fans are used, one set drawing the air from the suction duct and discharging into the coil room, the second set drawing the cold air from the coil room and forcing it into the cold-air supply duct. The speed of these two sets of fans is so regulated that the air pressure in the supply duct is maintained as much above atmospheric pressure as that in the suction duct is below that of the atmosphere, a system of automatic air valves at the end of the ducts farthest from the fans assisting in this regulation. The object of this air-pressure regulation is to maintain in the cars which are being precooled an air pressure as nearly as possible exactly equal to the pressure of the outer air, thus preventing any leakage of air either inward or outward. The air is cooled by passing over cold-brine piping in the coil room. The air ducts, which are insulated, are also refrigerated by brine piping to prevent the air in the ducts from becoming warmed by heat leakage through the walls. Brine, which is cooled by the ammonia system, is used for distributing the refrigeration, as it admits of storing up refrigeration in the cold brine in the intervals while no cars are being cooled. This stored refrigeration is utilized to give a colder air blast and promotes rapidity of cooling at the beginning of the run. The volume of air forced through each car is estimated at 6,000 cubic feet per minute.

PLANTS FOR PRECOOLING BEFORE LOADING IN CARS.

THE INSULATED-ROOM METHOD.

Five plants for precooling before loading in cars are now in operation in California. They have been installed by shippers or by local associations of growers and shippers. They consist of one or more insulated rooms, with arrangements for refrigerating the same either by mechanical means or by the use of ice and salt; provision is also made for air circulation through the rooms, usually by means of fans.

PRECOOLING PLANT AT POMONA, CAL.

The plant at Pomona comprises 6 insulated rooms, which are located in the basement of an orange-packing house. A large fan circulates the air from these rooms through a cooling room containing about 11,500 feet of ammonia expansion piping. Immediately after packing, the fruit is transferred to one of the cold rooms. The transfer of the packed boxes both into and out of the cooling rooms is accomplished by automatic mechanical conveyors, with a minimum of hand labor and with little loss of refrigeration by the opening of doors. About 6 cars of oranges per day are precooled to a temperature of 35° F., the usual period of cooling being about 48 hours. When used as a storage plant, 42 cars of fruit can be held in the cold rooms.

The ammonia for cooling the air blast is obtained by a pipe line from an adjacent ice-manufacturing plant, the charge for the refrigeration being based on a fixed price per box of oranges precooled.

PRECOOLING PLANT AT EAST HIGHLANDS, CAL.

The plant at East Highlands has 6 insulated fruit-cooling rooms on the first floor of an orange-packing house. It is a combined precooling and ice-making plant, the ice manufactured being used partly in icing the cars of fruit shipped from the packing house and partly disposed of in the local retail ice trade. The packed boxes of fruit are carried by automatic conveyors from the packing house into the cold rooms, and after precooling are trucked from the cold rooms into the cars. Folding canvas hoods, or vestibules, shown in Plate XLV, figure 1, extend against the sides of the cars and provide closed passages into the cars. Plate XLV, figure 2, gives a view in one of the cooling rooms, showing a portion of the conveyor and the method of marking the floor to insure regular placing of the boxes so as to leave proper spaces for air circulation. Each room is cooled by about 1,450 feet of 2-inch ammonia expansion piping arranged in a loft immediately above the room. No forced circulation is used. The ammonia plant used for precooling has a cooling capacity equal to 20 tons of ice a day. The plant is designed to cool the fruit from 90° to 34° F. in 48 hours at the rate of 2,600 boxes (about 7 carloads) per day. The rooms have a combined storage capacity of 24 cars of packed fruit.

PRECOOLING PLANT AT UPLAND, CAL.

The plant at Upland has 4 insulated fruit rooms, which are situated in the basement of an orange-packing house. The cooling is accomplished by the use of manufactured ice, which is crushed mechanically, mixed with coarse salt, and placed in large tanks located above the rooms to be cooled. In these tanks are coils of pipe filled

with calcium brine, which is chilled by the low temperature produced by the ice-and-salt mixture. The brine chilled in these coils circulates automatically by gravitation through another set of coils in a room below. The air in the fruit room is chilled by being forced over these cold-brine coils. Plate XLIII, figure 2, gives a view in one of the fruit rooms, showing the air ducts for distributing the cold air through a perforated false floor and ceiling. This system has been patented.

For the first 36 hours after warm fruit is placed in the precooling rooms the cooling is accomplished by a forced circulation of air through the ice-storage room in the basement and through the fruit rooms, in order to perform as much cooling as possible by the use of ice alone without additional expense for handling, crushing, and salting. After the fruit is partly cooled, lower temperatures are obtained by circulating the air from the fruit rooms over the colder brine coils. The usual period of cooling is about 72 hours, the temperature of the fruit at the end of this time being 38° to 40° F. The plant is designed to precool 3 cars of oranges a day and has storage capacity for 16 carloads of packed fruit.

PRECOOLING PLANTS AT NEWCASTLE, CAL.

The two plants at Newcastle are practically identical and form part of a proposed system of small plants operated from a common central refrigerating plant which furnishes cold air for the individual small precoolers. Each precooler consists of a single insulated room located on the main floor of a loading shed. At one side of the room is the precooling compartment proper, through which the packed boxes or crates of fruit are carried back and forth several times by a mechanical conveyor, which is the special feature of these plants. A strong blast of cold air is forced by a fan through the precooling compartment, which is but little larger than is necessary to allow the boxes or crates to pass through, so that the air current is confined closely to the fruit. After passing through the precooling compartment the escaping cold air cools the room which is used for holding the precooled fruit until it is loaded into the cars. By regulating the speed of the conveyor the time the fruit remains in the precooler may be varied from 20 to 80 minutes, according to the degree of cooling desired. On account of the short time that the fruit is exposed to the cold air, the actual reduction of temperature is small.

SMALL PRECOOLING PLANTS COOLED BY ICE AND SALT.

For several years orchardists in the valley of the Hudson River, in eastern New York, where natural ice is ordinarily obtainable at low cost, have used small cooling plants consisting of one or more

rooms, usually insulated with sawdust-packed walls and cooled by a mixture of crushed ice and salt, contained in upright tubes or cylinders of galvanized sheet iron ranged along the walls of the rooms. At the top the tubes terminate in a small box or tank of galvanized iron which is set into the floor above and covered with a tight-fitting lid. The ice and salt are hoisted to this upper floor and dumped into the tubes. Suitable gutters at the bottom of the tubes carry away the drip from the melting ice-and-salt mixture. The temperatures of the rooms are controlled by varying the proportion of salt used with the ice, temperatures as low as 32° F. being easily and steadily maintained.

On account of the proximity to important markets, the necessity for precooling fruits in these sections is not very urgent and these plants are used mainly for storage purposes, to enable the growers to pick and market their crops to best advantage. These plants may also serve for precooling on a small scale. The construction is simple and inexpensive, and the plants appear to be well adapted for the precooling or storage of fruits on a small scale in any locality where the cost of ice is not too great.

CONCLUSION.

Precooling has become a very important factor in the transportation of fruit. To the grower and shipper it is important as a means of extending the marketing area of the product by assuring its delivery in sound condition over long distances. To the carrier the sound condition of the fruit is an important consideration, but mainly from the traffic standpoint. Precooled fruit may be loaded more closely and heavily, thereby increasing the carrying capacity of the cars, and less ice will be consumed en route. But whether the reduction of the initial temperature is properly the function of the shipper or the carrier is still an open question.

As an adjunct to careful handling in preparing fruits for market, precooling will materially assist in minimizing losses from decay and deterioration in transit. It is in no sense a panacea for all the difficulties of carrying fruits in sound condition to distant markets. It can not improve the quality or condition of the product packed and can only temporarily retard decay following injuries made by rough handling; but it renders unnecessary the packing of such fruit as peaches, plums, and apricots in a hard, green condition in order to offset the ripening which takes place in cars under ordinary icing methods. It reduces the differences frequently occurring between the top and bottom tiers of the load by equalizing temperature conditions within the car.

CAMPHOR CULTIVATION IN THE UNITED STATES.

By S. C. Hood, *Scientific Assistant*, and R. H. True, *Physiologist in Charge, Office of Drug-Plant, Poisonous-Plant, Physiological, and Fermentation Investigations, Bureau of Plant Industry.*

INTRODUCTION.

The camphor tree seems to be native in the coastal regions of southeastern Asia, both on the mainland and in the southern part of the Empire of Japan. It is but natural, therefore, that the earliest records of the plant should occur in Chinese literature. In the sixth century A. D.[1] the tree was referred to as a valuable timber, no reference being made, however, to the gum. It is somewhat strange that a search of the older Chinese literature should have failed to develop any earlier references to either the tree or its rather striking product.

The name has been traced to various possible sources, among others to the Sanscrit "karpura," meaning white. The early literature of India, as well as the Greek and Roman classics, contains no references to camphor. It seems to have been well known to the Arabians, the gum having been first mentioned early in the sixth century A. D. It appears under the name of "caphura" in a medical prescription written at about this time by Actios, in Mesopotamia. During the ascendancy of the Arabians in the Mediterranean region, camphor seems to have become a well-known product enumerated among articles possessed by princes and other persons of great wealth. The refining of camphor seems to have originated with the Venetians, and was long thereafter carried on in Holland as a secret process. In time, however, information on the subject seems to have become more widely diffused, and with the return of travelers camphor trees were brought to the Occident. Camphor has long enjoyed a prominent place in medicine, but it was not until its usefulness in the making of various technical products was demonstrated that commerce in camphor reached great importance.

Within the last fifty years there has been a greatly increased demand for this product in the manufacture of celluloid and other nitrocellulose products. It enters into the manufacture of many pharmaceutical preparations, and from it are made various antiseptic com-

[1] See Flückiger, F. A., Pharmakognosie des Pflanzenreiches, 3d ed., Berlin, 1891, p. 159.

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pounds. It is also used as an insecticide. There are probably few plant products which find so many and such varied uses as camphor.

The following table shows the quantity and value of the importations of camphor during the past ten years:

Importations of camphor into the United States, for consumption, from 1899 to 1909, inclusive.[1]

Year ending June 30—	Quantity.		Total value.		Value per pound.	
	Crude.	Refined.	Crude.	Refined.	Crude.	Refined.
	Pounds.	*Pounds.*	*Dollars.*	*Dollars.*	*Cents.*	*Cents.*
1899	1,807,542	90,743	322,100	28,806	17.8	31.7
1900	1,789,580	109,971	485,071	42,901	27.1	39.0
1901	2,175,874	77,313	738,875	39,507	34.0	51.1
1902	1,831,058	186,882	576,405	61,592	31.5	33.0
1903	2,508,420	43,696	764,403	19,399	30.5	44.4
1904	2,819,883	152,558	874,709	64,234	31.0	42.1
1905	1,924,077	214,050	638,765	117,277	33.2	54.8
1906	1,668,799	338,458	608,463	207,813	36.5	61.4
1907	3,138,397	463,977	1,572,881	373,137	50.1	80.6
1908	2,811,358	519,890	1,365,287	322,755	48.5	62.1
1909	1,990,499	430,564	602,530	151,990	30.3	35.3

[1] From annual reports of Foreign Commerce and Navigation of the United States, published by the Department of Commerce and Labor.

The greater part of the world's supply of camphor comes from Formosa, but there is a relatively small production in Japan. The Japanese camphor monopoly controls the entire output of Japan and Formosa and is said also to handle a considerable portion of that produced in China. The output of the monopoly for the year ended March 10, 1910, was about 8,000,000 pounds of camphor and camphor oil.

Within recent years there has been a revival of the industry in the Chinese province of Fukien, and during the year 1909 there were shipped from that province to Foochow about 1,064,000 pounds of camphor and 2,660,000 pounds of the oil. In both China and Formosa camphor is made from the native forest trees and until recently there had been no serious movement toward replanting. The camphor forests are thus becoming exhausted, and if the cultivation of this tree is not begun we must inevitably face a shortage of camphor with consequent high prices.

PRESENT METHODS OF MANUFACTURE.

Until recent years no attempt has been made in either China or Formosa to improve the methods of camphor manufacture. The usual apparatus consists of a shallow iron kettle supported over a stove made of stones and clay, the kettle being fitted with a perforated

wooden cover, over which is placed a bottomless wooden tub with a removable cover. A bamboo tube leads from the tub to a series of wooden boxes, over which water is run for cooling purposes. These boxes, which serve as the condenser, are sometimes filled with bundles of rice straw to facilitate cooling.

The apparatus is set up, if possible, by the side of a small stream near the trees to be worked up. The trees are felled, the trunks, roots, and large branches cut into small chips, and the tub filled with this material. Steam is generated in the kettle and passes through the cover into the tub filled with the chips. The camphor is taken up by the steam which passes through the bamboo tube, and is cooled and condensed in the boxes, where it is deposited in a solid mass. From time to time various minor changes have been made in the apparatus. At present, in some parts of Formosa an inverted sirup evaporator is used as a condenser in place of the boxes.

This apparatus seems crude, but it has the advantage of being portable and can be carried farther and farther into the forest as the trees become exhausted. Furthermore, the work is carried on in those forests where the workers are exposed to the raids of the "head-hunters," and many stills are destroyed annually by these tribes. In Japan some progress has been made in devising improved apparatus, but the new condensers have not yet come into general use.

CULTIVATION OF CAMPHOR IN THE UNITED STATES AS AN ORNAMENTAL.

When the camphor tree was first introduced into this country is not clear. There are several trees in Florida which were brought in as seedlings between 1870 and 1875, and from their seed have been grown many of the camphor trees of that State. About 1880 the Department of Agriculture distributed seed and young trees, and these also have yielded stock for nursery purposes.

During the past 10 years camphor trees have been very extensively planted for ornamentals and windbreaks in the Southern and Southwestern States and in some places nearly every home has one or more camphor trees in its yard. One Florida nursery alone sells annually about 15,000 trees.

Although the introduction of the camphor tree was undertaken in the earlier days chiefly because of the value of this plant as a shade tree, the idea of its eventually proving useful for the production of camphor was not altogether overlooked. Mr. William Saunders, in the report of the Department of Agriculture for 1889, says "they answer a good purpose as ornamental shade trees, with a probability that when they become more plentiful and better known efforts may be made to extract camphor from the branches." Such efforts seem, however, to have been rather long delayed. In the summer of 1904,

as a part of the work of the then newly established laboratory of drug-plant investigations, Mr. W. O. Richtmann was sent into the field to investigate the camphor content of the trees previously introduced. Camphor material was distilled in Florida, Texas, California, and others of the warmer States. Encouraged by the favorable results obtained, the Department made arrangements to secure the use of land at Huntington, Fla., to be chiefly devoted to camphor work. This work took on an unusual interest shortly after it was undertaken on account of the high price to which Japanese camphor rose, supposedly because of the speculative operations in Japan and elsewhere. The wholesale market price of American refined camphor during the eight years from 1902 to 1909, as presented in the following table, shows strikingly the effect of powerful disturbing influences.

Price per pound of American refined camphor, 1902 to 1909, inclusive.

[From volumes of the Oil, Paint, and Drug Reporter, New York.]

Years.	Highest price.	Lowest price.	Years.	Highest price.	Lowest price.
	Cents.	*Cents.*		*Cents.*	*Cents.*
1902	57	54.5	1906	117	88
1903	58.5	54.5	1907	124	68
1904	93	58.5	1908	68	50
1905	88	68	1909	50	45

These preliminary experiments seemed to show that camphor gum and camphor oil are produced under American conditions in quantities sufficient to justify further work. Shortly after the preliminary plantings had been made at Huntington, the experiment was removed to Orange City, Fla., in order to obtain somewhat better facilities. The results summarized in this paper were almost wholly worked out after the removal to the latter point.

METHODS OF CULTIVATION.

The camphor tree is hardy where the winter temperature does not fall below 15° F., but even at this temperature some loss of small branches will occur if the tree continues to grow until late in the season and has not become completely dormant before the frost comes. The tree easily adapts itself to new conditions, and can be grown on a wide range of soils; in fact, it can be grown on any soils except on very low land where water stands part of the year. The maximum growth occurs, however, on a rich, well-drained soil (Pl. XLVI, fig. 1).

For commercial cultivation it is probably best to plant on low-priced sandy land, since in this situation the trees do well with less cost for cultivation and a smaller initial cost of land.

FIG. 1.—CAMPHOR TREE ABOUT 16 YEARS OLD. GROWN IN FLORIDA.

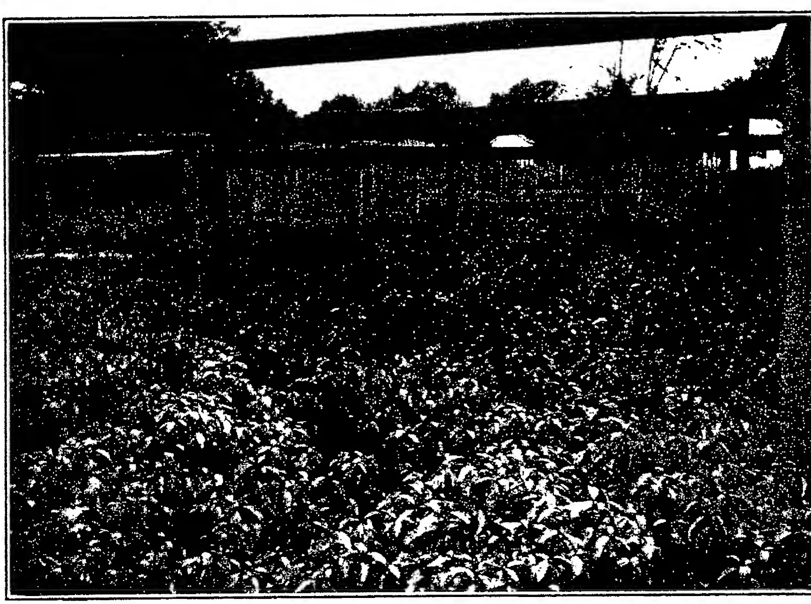

FIG. 2.—COVERED CAMPHOR SEED BED WITH THE COVER REMOVED TO HARDEN OFF THE PLANTS.

PROPAGATION.

Camphor can be propagated by seed, cuttings, and root cuttings, but for commercial purposes the first method is to be preferred, except in cases of special varieties having some valuable characteristic which would not be reproduced by the seed. In propagation by seed great care should be taken in the selection of the land for the seed bed (Pl. XLVI, fig. 2). If possible, a rich, well-drained soil which has been under cultivation in previous years should be found. If this is not possible, new land can be used; but in either case land infested with Bermuda grass or maiden cane can not be used, since the roots of these grasses will take up the moisture in the soil and prevent the germination of the seed.

THE SEED AND SEED BED.

The land should be plowed about September 1 and well cut up with the disk harrow. About October 15 it should again be worked and all dry roots and trash removed. Too much emphasis can not be placed on the preparation of the seed bed, since after the seeds are planted no cultivation can be given for three months.

In size and shape, camphor seed resembles the common wild black cherry, consisting of a small stone surrounded by a fleshy pulp covered with a thin black skin. When the seeds are ripe, about October 15, they are of a dull-black color and are then ready to be gathered.

The seed bed should be prepared before the seed are gathered, and as soon as secured the berries should be planted fresh with the pulp left on. For convenience in future handling, the seed should be planted in hills 3½ feet by 1½ feet, with three seeds to the hill, and covered about 2 inches deep. This method will require about 24 quarts of seed per acre and will produce enough trees for setting 16 acres of field planting.

CULTIVATION.

The seeds will begin to come up about three months after planting, but four or five months are often required for a full stand. The percentage of germination is very low and only about one-half the seeds may be expected to grow. Cultivation should begin as soon as possible, and as soon as a full stand is obtained the plants should be thinned to one in a hill and given a good dressing of high-grade fertilizer.

The first season the plants should make a growth of 12 to 18 inches, with a very large and vigorous root system. The treatment the second year should be the same, and at 26 months from planting the plants should be from 2 to 3 feet high and well branched. At this time they are ready for field setting.

GROWTH.

The root system of a 2-year-old camphor tree (Pl. XLVII, figs. 1 and 2) consists of a taproot 1 inch in diameter at the top and about 3 to 5 feet long. Up to this time the laterals are represented mainly by small fibers on the taproot. In transplanting under commercial conditions these fibers are killed and are not renewed as quickly as in some other trees. The tree must be set early in the fall in order that the root system may be well established before the hot weather of the spring comes on. Experiments have shown that setting in December gives the best results.

PREPARATION OF LAND FOR PLANTING.

The land should be well prepared by deep plowing early in the fall and again worked just before the trees are set. It is desirable to lay off the rows in checks 6 by 15 feet, since this will facilitate later cultivation. The trees can be dug with a tree digger and should be cut back very severely. All leaves and small twigs should be removed (Pl. XLVII, figs. 3 and 4) and the tree well headed back. The taproot should be cut back to 12 inches and all the small laterals removed.

The trees should be set at the same depth they were in the seed bed, and a small basin formed by the soil about them for the reception of water. One application of water should be given when the trees are set and one or two later on, as needed, if the rainfall is scanty. No growth will take place in the roots if dry soil is allowed to remain in contact with them, but too much water will cause the roots to sour and die. In those parts of the South where there is a definite rainy season good results can be secured by setting the trees about July 1, no watering being needed except a small application at the time the trees are set. By this method the trees have a tendency to continue growth until late in the fall or early winter, and are exposed to danger of frost, since they are very tender when in a growing condition. In frost-free localities, however, this method can be followed with less expense. Plate XLVIII, figure 1, shows such a young camphor nursery well established.

FERTILIZING AND CULTIVATING.

The question of fertilizer for the trees after they are in the field has not yet been worked out. Experiments have shown that the trees respond very readily to fertilizer, but whether the additional growth will pay for the material used has yet to be determined. It is fairly certain, however, that it will pay to apply about 2 pounds per tree for the first two years, until they get well started.

Cultivation should be thorough and frequent, and, where it can be done, small crops, such as cotton, peas, and corn, should be grown

between the rows for two or three years. If, however, a tall-growing crop, such as corn, is used, care should be taken not to plant too near the trees, since even slight shade retards growth.

At five or six years from the seed the trees should be 7 to 8 feet high and very bushy. At this time the trees should be trimmed to shape them up into hedges and the first harvest should be secured.

HARVESTING.

Up to the present time nearly all camphor is made from the wood of old forest trees and but little use has been made of the leaves and branches. This is partly due to the fact that in the camphor countries the camphor is localized mostly in the old wood, while that in the leaves contains a large percentage of oil. In the Southern States the camphor yield of the leaves is high and there is little in the wood before it reaches an age of 10 years or more. To grow the tree for the wood means long waiting for returns and the ultimate destruction of the tree.

Experiments have shown that the tree can be handled in hedges and kept trimmed back to a height convenient for working. In fact, camphor is often used as a hedge tree in the South and responds to trimming more readily than almost any other tree or shrub. This adaptability for hedges can be taken advantage of for commercial purposes, repeated experiments having shown that the camphor yield can be greatly increased in the leaves by trimming.

On the Department's experimental plats the trees are planted in rows 15 feet apart and 6 feet apart in the row. They are grown to an A-shaped hedge 8 feet high and 8 feet wide at the base. By this method they are kept back to a convenient size for working and are not dwarfed sufficiently to injure the vigor of the tree. At six years from the seed the trees will form a solid hedge in each row and will be thick and bushy to the ground.

Camphor is represented in the growing tissue by oil, which as the leaves mature is changed into camphor. Distillations made at different times during the growing season show a rapid gain in camphor content as the leaves approach maturity; also that it is highest during the dormant period.

In most places in the South the tree has two growing seasons and two dormant periods. Growth begins in February and before May 1 a leafy growth of 6 to 10 inches has formed. On this growth are formed the flowers and seed. From May 1 to June 15 the weather is hot and dry and the tree goes into a dormant period. With the coming of the summer rains growth begins again and continues until about the middle of September, when the winter dormant period begins.

CAMPHOR CONTENT OF LEAVES AND TWIGS.

After the spring growth begins, there occurs the fall of the leaves 12 and 18 months old. Under normal conditions all leaves remain on the tree one full year. Distillations made from leaves of different ages showed a slight decrease in camphor content after maturity is reached, but a large proportion of the camphor remains in the leaf until it falls. Distillations from dead leaves fallen from the tree gave a yield of 2 per cent of oil and camphor. The loss of camphor in the leaf as it matures and dies is greater, however, than the percentages show, since there is also a loss of water and a consequent decrease in the weight of the material.

With the twigs the difference is still greater. At the close of the growing season the twigs were found to contain as high a percentage of camphor as the leaves on them, but the yield from older twigs was very low. This is due to the fact that in the twigs the camphor is in the bark and almost none is localized in the new wood.

These experiments show that if the hedges are trimmed at the end of each growing season a maximum quantity of camphor is obtained with a minimum of useless material to handle. The hedges can be trimmed by machinery, so that the cost of harvesting will be small, and with some minor changes some types of machines now in use can be utilized. The Department of Agriculture is working on this problem, but as yet the tests are incomplete. After cutting, the trimmings should be taken to the distilling plant at once, since if they are allowed to dry in the sun or remain exposed to the dew and rain there is some loss of camphor.

DISTILLATION METHODS.

Camphor is obtained in the same manner as other volatile-oil products; that is, by steam distillation. When steam is passed through a suitable receptacle filled with the leaves the camphor is extracted in the form of a vapor and passes off with the steam. If the camphor-containing steam is conducted into a condenser, the steam is condensed to water and the camphor is deposited as a solid or semisolid mass floating on the water or deposited on the inside of the apparatus. The volatile oil remains as a pale liquid floating on the water.

When brought from the field, the trimmings should be elevated to the top of the building, where they can be stored in bins until wanted for the retort. They should not be allowed to remain more than a day or two, however, since if piled in large heaps sweating will occur and some of the camphor will be lost. As needed, this material can be delivered to the retort through chutes with a minimum of time and labor.

FIG. 1.—CAMPHOR SEEDLING FROM COVERED SEED BED BEFORE CUTTING BACK FOR SETTING IN DECEMBER.

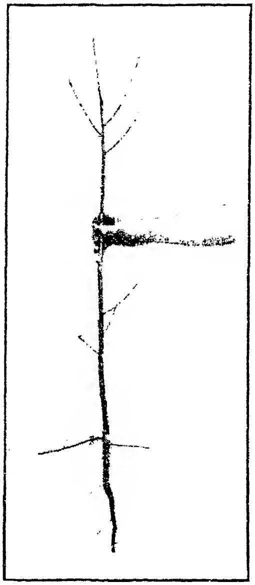

FIG. 3.—CAMPHOR SEEDLING FROM COVERED SEED BED CUT BACK FOR SETTING IN DECEMBER.

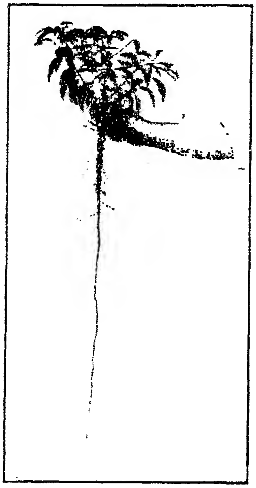

FIG. 2.—CAMPHOR SEEDLING FROM OPEN SEED BED IN DECEMBER.

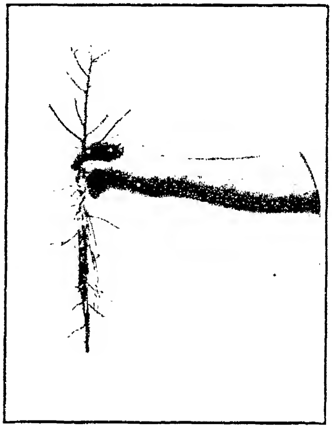

FIG. 4.—CAMPHOR SEEDLING FROM OPEN SEED BED CUT BACK FOR SETTING IN DECEMBER.

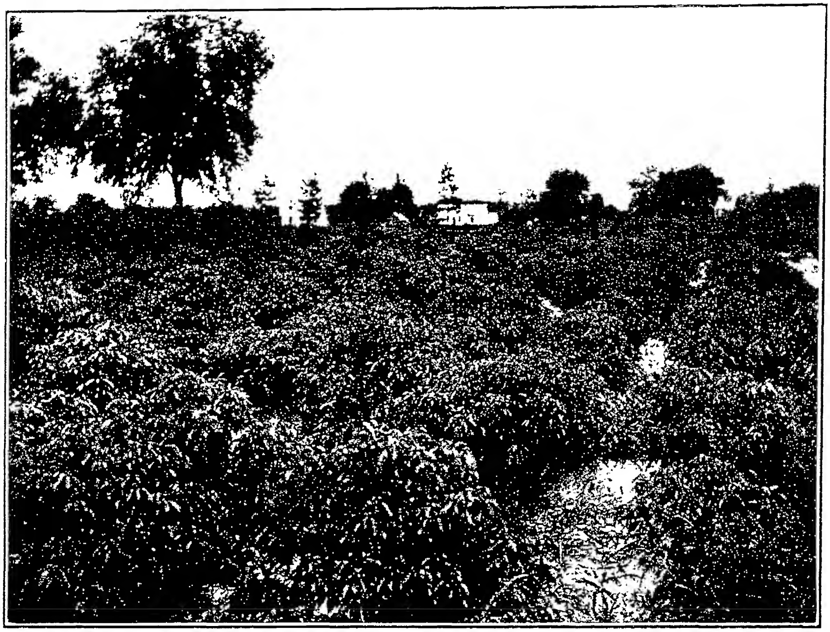

FIG. 1.—CAMPHOR NURSERY SET IN THE SPRING OF 1908.

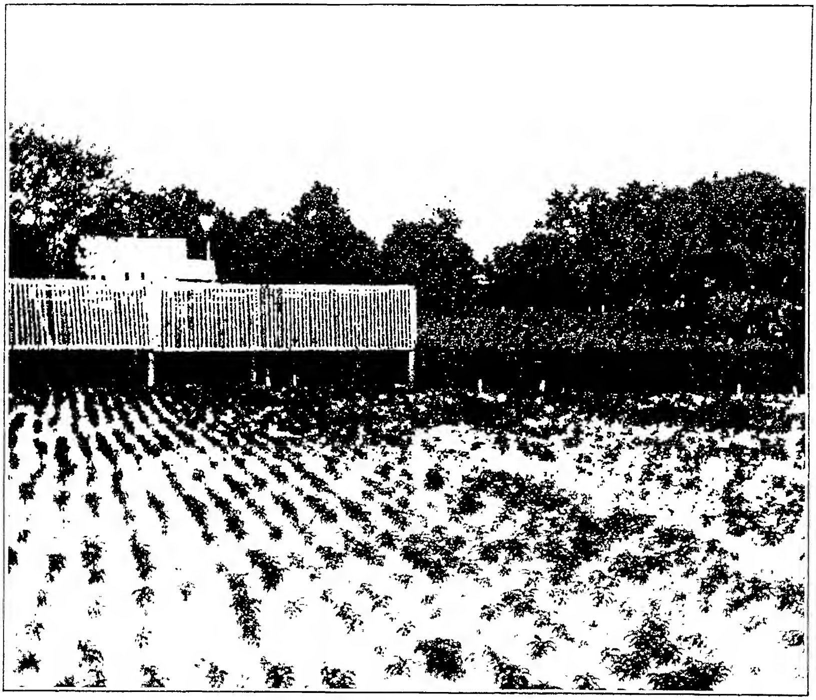

FIG. 2.—CAMPHOR SEEDLINGS IN UNPROTECTED SEED BED.

Any of the standard types of retort employed for other volatile oils can be used for camphor. The most common one is a circular wooden vat about 6 feet in diameter and 8 to 10 feet deep. This is fitted with a removable cover, which can be made steam tight. The retort is fitted with a perforated false bottom, and to its edges are attached four chains reaching to the top of the retort. Steam is admitted to the bottom through a pipe from a boiler. The retort is closely packed with the trimmings, the cover fastened down, and the connections with the condenser made. Steam should be admitted under pressure, but no pressure should be developed in the retort. To prevent this the outlet pipe should be twice the size of the inlet pipe. The time required for distillation depends on the size of the charge, the closeness of the packing, and the amount of steam used. When exhausted the charge can be hauled out by means of tackle attached to the chains and the material carried on a track to the dump heap.

This type of retort gives good results with camphor trimmings, except that some difficulty is experienced when the charge is drawn out. This material, consisting of leaves and short twigs, does not hang together well and the charge is likely to fall to pieces before it can be gotten to its destination. If rods are used in place of chains, and to them is fastened a fine-meshed wire netting fitting closely to the sides of the retort, this difficulty is done away with. With this device, however, the material can not be packed closely to the sides of the retort and uneven steaming is the result.

When metal retorts are used they are attacked by the camphor vapors and a deposit of oxids and sulphids of the metal is carried over with the camphor. This causes a black impurity in the camphor which injures its appearance, but as all crude camphor must be refined before using this impurity is later removed. It is almost impossible to avoid some of this impurity, since metal must enter into the construction of some parts of the apparatus.

METAL RETORTS.

If a metal retort is to be used, it should be made of boiler iron three-sixteenths of an inch thick and cylindrical in shape. A capacity of 200 cubic feet will contain a ton of trimmings if closely packed. The cover of the retort should be slightly conical in shape, with the outlet pipe in the center. It should be riveted to a flange fitting a similar flange on the body of the retort, so that the joint can be made steam-tight by means of a packing ring. The fastenings should be swinging eyebolts attached under the lower flange and let into both flanges by slots. The bottom of the retort should be of the same construction as the top, but should be nearly flat and hung to the retort by a heavy hinge on one side. The fastenings should be of the same sort as those used in the cover. The swinging bottom should

be fitted with a false bottom of heavy wire netting of about 1-inch mesh, and supported on pillars raising it 4 inches from the inside of the bottom. The steam inlet should be by two pipes on opposite sides entering the chamber formed between the true and false bottoms. In this manner an even distribution of steam is secured over the bottom of the charge. The retort should be raised several feet from the ground, so that when the charge is exhausted the bottom can be swung back and the charge allowed to fall out into a car, which can convey it on a track to the dump heap.

This type of retort is much more expensive than the wooden one, yet the greater durability and convenience will more than compensate for the extra cost. A type similar to this is used for the distillation of pine chips, but this type is constricted at the top and bottom and the swinging bottom is of much smaller diameter than the body. This can not be used for camphor, since the charge will strike the shoulder at the bottom and have to be removed by hand.

The time required for distillation depends on the size of the charge and the amount of steam used. A ton charge can be completely exhausted in from two to three hours with a moderate amount of steam.

THE PROBLEM OF THE CONDENSER.

The problem of securing a condenser for camphor has been a difficult one. It is out of the question to use wooden boxes or inverted sirup evaporators, as in China and Formosa, and none of the types of condensers used for oils can be used, since the condensed product is a solid and deposits on the inside, completely filling it. Tubular and coil condensers are also out of the question. Several condensers of an entirely new type have been devised and comparative tests are being made with them. One has been secured which so far has given excellent results, but the tests are not yet completed. In the near future the Department of Agriculture hopes to have this problem worked out and to be able to recommend a condenser which will meet all the requirements of commercial work.

REFINING.

As received from the condenser, the camphor is in a very impure state. It is a semisolid mass of a brownish color and about the consistency of melting snow. This crude camphor contains about 75 to 80 per cent of pure gum camphor and about 15 to 20 per cent of camphor oil, the remainder consisting of oxids and sulphids of iron, water, and other foreign matter. This crude product must be refined before it can be placed on the market.

The first step in this process is to remove the oil. This is done by throwing the mass into a centrifuge giving a centrifugal force of 550 to 600 gravities. By means of this machine nearly all the oil can be

removed, and washing with warm water while still in the centrifuge will remove almost the last trace. The camphor thus secured is dry, but still has a brownish color, due to the metallic impurities. By the regular process of sublimation in iron kettles, the camphor can be secured in either the transparent slabs or "flowers of camphor," as is desired.

The oil secured from the centrifuge is of a brownish color and is one of the most complex of volatile oils. It contains several constituents which find ready sale in the trade, but chief among them is the camphor which is dissolved in it to the extent of about 30 to 35 per cent. By fractional distillation and subsequent freezing of the camphor-containing fractions, this camphor can be secured and added to that first obtained.

The camphor oil secured from the wood in China and Japan contains a high percentage of safrol, and the fraction containing this is used in the trade in artificial oil of sassafras. Oil secured from the wood of Florida-grown trees contains good percentages of safrol, but little or none is found in the oil from the leaves.

YIELD.

Distillations made from more than 1,000 trees in Florida, Texas, Alabama, Louisiana, and California show that there is a very wide range in the camphor yield of the leaves and twigs. Some samples from trees which had been shaded by buildings or by other trees have given as low as 0.70 per cent of camphor and oil together. Other trees which have been retarded in growth by being planted on very poor land and given no care have given as high as 2.77 per cent of camphor distillate. These, however, are extremes, the usual yield being from 1.75 to 2.25 per cent. All these percentages are based on the green weight of the material and are given in the percentage of crude camphor distillate secured. The amount of pure gum camphor in the crude product shows but slight variations and usually falls between 75 and 80 per cent. The usual yield of pure gum camphor from leaves and twigs of single trees is from 1.35 to 1.50 per cent, calculated on the green weight of the material. It has been shown, however, that the yield is increased by trimming, and a larger yield can be secured from hedges.

As yet the hedges planted by the Department of Agriculture have not reached sufficient size for trimming, and it has not been possible to secure a satisfactory estimate of the yield per acre to be obtained. A number of tests have been made on ornamental hedges of various sizes and ages, but the material has been too limited to furnish definite data on the yield of hedges planted on a large scale. It is thought safe in estimating, however, that hedges planted 15 feet apart with the plants 6 feet apart in the row, grown 8 feet high, will give 8,000 pounds per acre of trimmings for each of two cuttings, making a total

of 8 tons per acre each year. This will give from 175 to 200 pounds per acre of marketable camphor. The trimmings of measured areas on ornamental hedges have far exceeded this, but it is well to avoid using the yield of a few square yards in estimating the yield per acre.

FROST.

In those parts of the South where valuable fruit groves have frequently been lost by sudden frosts, the first question raised is, "What will frost do to a camphor plantation?" If the temperature falls below 15° F. or occurs when the trees are in a growing condition, the smaller branches will be killed. During the freeze of 1895 in Florida many trees were killed to the ground, but this was due to the fact that the freeze came when the trees were in a growing condition. In December, 1909, there were in the nurseries of the Department of Agriculture at Orange City, Fla., 30,000 trees 1 and 2 years old. These withstood a temperature of 16° F. for three consecutive nights and suffered but slight injury. If, however, a plantation of camphor hedges should be killed to the ground they will renew themselves from the roots in one year. Experiments have been made in cutting down trees 6 to 10 years old, and in all cases they have made a growth of 6 to 10 feet the first year. The deadwood from frozen trees contains sufficient camphor to pay for working up, and the killing of trees to the ground would not even necessitate the shutting down of the distilling plant.

FUTURE OUTLOOK.

In many parts of the South, especially in Florida, there are large areas of light sandy land not well suited to general farming. This land can be secured at a low price and there is every indication that camphor growing on this land can be made a commercial success. The demand for the product is steady and if it could be supplied from a source less liable to price fluctuations than at present it is probable that larger quantities of it would be used in the arts.

At the present time it is not advisable to plant camphor in small areas with the hope of securing a profitable income by selling the trimmings to a near-by distilling plant. It is a question as to how far it will pay to transport this material, and a planter might be left with a worthless overgrown plantation on his hands if a distilling plant should not be in operation in his vicinity by the time his trees were ready for trimming. Until the industry becomes well established planting should be on a sufficiently large scale to warrant the building of a distilling and refining plant in connection with it, and for this purpose 200 acres may be considered a minimum area. The cost of production per pound will be less if made on a much larger scale. It appears probable that an area of 500 acres will warrant the installing of sufficient machinery to produce camphor at a minimum cost.

THE EFFECT OF THE PRESENT METHOD OF HANDLING EGGS ON THE INDUSTRY AND THE PRODUCT.

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Food Research Laboratory, Bureau of Chemistry.

VALUE OF THE OUTPUT.

During the calendar year 1909, 4,256,320 cases of eggs were received in the city of New York.[1] Each case contained 30 dozen, hence there were 1,532,275,200 individual eggs, or enough to permit of a per capita consumption per annum of 321.[2] If these per capita receipts in New York, inclusive of losses at the market center, be taken as an approximate indication of the per capita production throughout the United States, exclusive of our island possessions, we are producing annually 82,000,000 cases of eggs, with a probable value of $485,-000,000. According to the report of the Secretary of Agriculture for 1907, "more than $600,000,000 must be regarded as the value of the poultry and eggs produced on the farms in 1907. The amount may easily have been larger. This industry has advanced at such a rapid rate that no arithmetic can keep up with it." Again, in 1908, he says "the eggs and poultry produced on the farms are worth as much as the * * * hay crop or the wheat crop," the latter being estimated at $620,000,000 for 1908.

In eggs and poultry, then, we have an agricultural product of enormous money value, considered either individually or by comparison with our other agricultural productions. About 89 per cent of our farmers raise chickens; hence, eggs may be said to be a universal food, as well as a food of high nutritive value. The output of eggs is steadily growing, but the demand is growing even faster than the supply, due to the increased price of meat, as well as a preference for eggs as food; hence, the price of eggs has gone up. In 1899 the farm price was 11.15 cents per dozen, as an average for the United States; in 1909 the average was 19.7 cents, weighted according to monthly production.[3] These are the prices to the producer, not the consumer. The latter pays from 50 to 100 per cent more than the producer receives. Some of the reasons for this increase to the consumer will be discussed in this article.

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[1] New York Mercantile Exchange.

[2] Population of Greater New York, according to census of 1910, 4,766,883. Population of the United States, according to census of 1910, 92,000,000.

[3] U. S. Dept. Agr. Yearbook, 1909, p. 589 (calculated).

CENTERS OF PRODUCTION.

Though the production of eggs is so widespread, only the States of Ohio, Indiana, Illinois, Iowa, Minnesota, Nebraska, Kansas, Missouri, Texas, Tennessee, and Kentucky produce more than are consumed within their own borders, and this production does not cover the entire year, but only those months when climatic conditions are favorable to laying. Fortunately for the devotee of the "fresh egg," it is being produced the year round in one section or another of the United States. The lay in Tennessee and Kentucky is from December until April. In March and April southern Ohio and Missouri stocks appear on the market, helped along by Texas, southern Missouri, and southern Kansas. In the later spring northern Kansas, Iowa, Indiana, Illinois, and the Central States generally have their heavy producing season, and it is when this occurs that eggs are best and most plentiful. Minnesota and Michigan, with a still later season, help out somewhat when the supply of the Central States begins to fail, but the output of both the southern and northern egg belt is far from adequate to supply the demands of the widespread consuming public.

Such climatic conditions as prevail during March and April in the Central States, both east and west, are ideal for egg production and egg marketing. Hence it is only necessary to know the climate of a region in order to know when its egg supply is greatest and best. If one considers the number of months each year when climatic conditions preclude egg production almost entirely over nearly the whole of our great egg-producing territory, it is plain that some provision for these months of scarcity must be made from the season of plenty if eggs are to appear the year round on the tables of any except wealthy people. The development of the resources of Kentucky and Tennessee will help to ease the demand of the eastern markets for "best fresh" eggs during the winter months, but it can never satisfy the general demand any more than the northern belt, as represented by Michigan and Minnesota, can keep all supplied during the heat of midsummer. Therefore, we must continue to study, and work for, and urge, increased egg production wherever the little feathered lady can manage to eke out a living by dint of hard scratching, be it north, south, east, or west. And we must remember, too, that every new-laid egg is fresh, sweet, nutritious food. It may be small, or dirty, or thin shelled, which faults are at the door of the farmer who disregards breed, feed, and clean and sufficient laying quarters for his hens. The hen has kept pace with her breed and her environment, and almost invariably, even under the worst conditions, she gives her owner more than she receives. What becomes of the fruit of her clucking and endless scratching

and unwearied searching for an egg-producing life? She goes singing to her nest and lays a perfect egg; but how many of her lay reach the consumer fresh and sound, and what part does marketing play in the sum total of the quality of the product, the cost to the consumer, and the return to the industry all along the line?

GRADES OF MARKET EGGS.

Let us see what sorts of eggs are found in our markets. Here are rotten eggs, broken eggs, cracked eggs, dirty eggs, and stale, shrunken eggs, and last—unfortunately many times least also—are the fresh, sound, clean eggs, which the market calls "firsts." What causes contribute to this list of undesirable and loss-producing grades? Three causes mainly, (1) climatic conditions, (2) careless or deliberately bad marketing, (3) poor care of the poultry on the farm. Now, in order to understand more clearly the relation between the low market grades and their principal causes, we must first consider briefly what these commercial grades are and how they are determined.

Eggs are graded for market according to size, freedom from dirt and cracks, and freshness. For some markets, such as New York and Boston, the color of the shell is also taken into account, the former market paying several cents a dozen more for white-shelled eggs and the latter putting the same premium on the brown shelled.[1]

THE PROCESS OF CANDLING.

Size, cleanliness, cracks, and color may readily be determined by inspection; freshness, in the sense of a high quality, firm-bodied egg, rather than in the lapse of time since laying, is determined by a process known as "candling." The egg candle consists of a bright light, generally an electric incandescent bulb, protected on all sides by an opaque shield in which are one or two oval holes a little smaller than the egg. The eggs are pressed firmly against these holes and, as the light shines through, the yolk and white may be seen, as well as the air space at the large end of the egg and any foreign bodies that may be present.

An egg which has just been dropped and is still warm entirely fills its shell. But as it cools to the temperature of the air it contracts, leaving a small space at the large end of the egg empty. As the egg ages, whether from long keeping under favorable conditions or short holding under bad conditions, this space increases in size, due to the escape of moisture from the egg through its shell. When the air space becomes pronounced—it may in extreme cases occupy

[1] This, it may be said in passing, is a good illustration of market fashions, since the most careful chemical analyses have so far failed to show any difference in the composition of the eggs themselves.

almost half the shell—the egg is known as "shrunken;" it has lost its fine flavor, it is stale, and it sells to the commission man, to the retailer, and to the consumer at a reduced price. The size of the air space is determined by candling.

GRADING BY THE CANDLE AND BY INSPECTION.

A fresh egg, held before the candle, shows the yolk but faintly as a reddish ball in the center of the shell. It moves if the egg is quickly rotated, but it is disinclined to do so. As the egg ages the position and opacity of the yolk change; it becomes freely movable, perhaps rising, perhaps falling, in the shell and acquiring sharper outlines. "Stale" eggs are classified very largely by these characteristics and are undesirable because of loss of quality and money value.

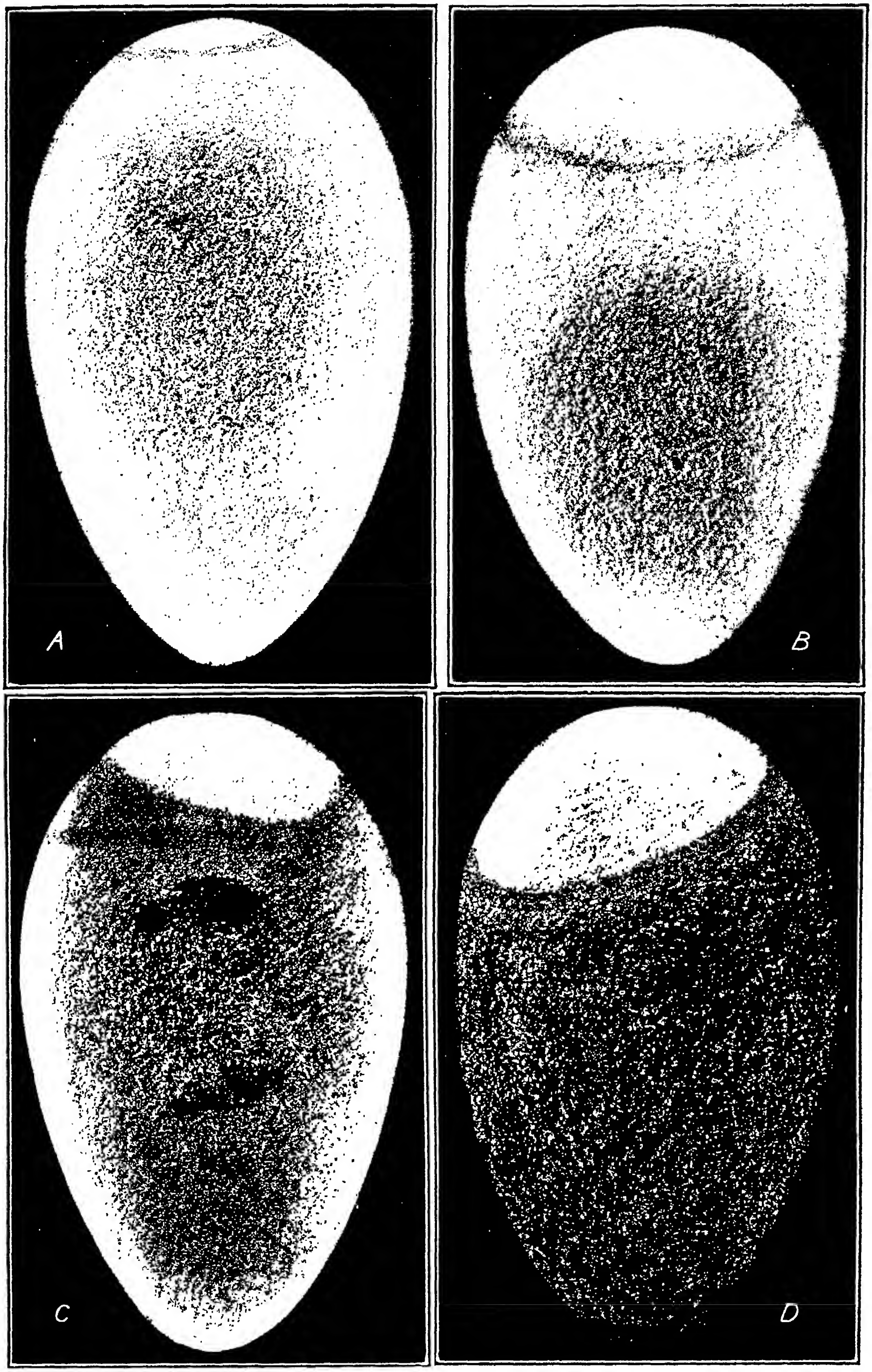
The rotten egg before the candle is opaque, or dark colored, and is homogeneous. Rottenness may be caused by a developing chick or by the growth of fungi. Rots are a total loss.

A "spot rot" is an egg in which the yolk has stuck to the shell or in which fungi have formed a visible growth, and is due to long holding. These eggs are lost as foodstuffs, but can be used by tanners. (See Pl. XLIX.)

"Spots" are either particles of fungoid growth, seen as dark masses in the body of the egg when viewed by transmitted light, or the round, characteristic area, varying in size from a small pea to an inch or more, caused by the developing embryo. It is these "spot" eggs which have recently been the cause of so much controversy between the industry and the public officials charged with safeguarding the wholesomeness of the food supplies of the people. When the area of germination is not sufficiently great to completely rot the egg—even though it has proceeded far enough to form a network of blood vessels and a plainly visible embryo—it has been the habit of certain shippers at the source of production, and also receivers at the market center, to break such eggs into large tin buckets, either with the "blood ring," as the germinal spot is often called, or after that has been mechanically removed, and hard freeze the mass of mixed white and yolk, holding the eggs frozen until needed by the bakers.

Public health officers, backed by growing public opinion, in which the more intelligent shippers and receivers are joining, have been endeavoring to prevent the use of such eggs for food. Their use by tanners is legitimate, but the number of them on the market at certain seasons is enormous, and with the tanners as the only outlet the losses will be very heavy. How it happens that so great a number of "spot" eggs appears for marketing will be shown later.

"Checks" are eggs showing cracks, either those which are "blind," that is, very small, or those which are easily seen yet which do not



APPEARANCE OF DIFFERENT GRADES OF EGGS BEFORE THE CANDLE.

A, fresh egg; *B*, stale, shrunken egg; *C*, fungous, "spot" egg; *D*, black, rotten egg. (Enlarged one-third.)

permit the contents to escape. As opposed to these are "leakers," where the shell is badly broken. Such eggs are sold for food, but at a lower price.

"First quality" eggs are fresh, large, weighing at least 45 pounds to the case of 30 dozen, clean, and with sound shells.

"Second quality" are clean, sound-shelled eggs, which are undersized and which may be fresh; or they may be shrunken and stale from long holding, or from incipient chick development which has not yet reached the "blood ring" stage. The latter form a large proportion of the second quality eggs during the summer season. Full-sized, clean, sound, stale eggs also go as "seconds."

"Dirties," which need no definition, are of varying size and freshness, but are always sold at a lower price.

EFFECT OF DAMPNESS AND HEAT ON QUALITY.

Having now some idea of the grades of eggs on the markets, let us see what causes contribute to produce them. It has been said that climatic conditions have the greatest influence on the quality of the eggs coming to the markets. Too much rain means that the hens have muddy feet, hence the eggs may be soiled even when deposited in clean nests; but when laid hither and yon, in stolen or unkempt nests, as so many farmers permit their birds to lay, the proportion of dirty eggs is greatly increased. Dampness, too, induces a more rapid growth of the bacteria or fungi which are commonly present even in new-laid eggs, but which are in such small numbers that they can be disregarded unless conditions favorable to their multiplication arise.

Heat, however, is the most prolific source of trouble. Hot weather not only puts the hen out of condition, but it hastens all the evils that an egg is heir to after it is laid. Its flavor is lost sooner; evaporation is hastened, hence the shrunken egg comes more quickly; worst of all, the development of the embryo in the fertilized egg proceeds with a greater and greater steadiness and rapidity as the temperature rises, resulting in the "rots" and "spots" of commerce. It is the medium temperature of March, April, and part of May that is responsible for the high proportion of fresh eggs on the spring markets, as well as the fact that, because the price is apt to fall, the producer ships his eggs quickly. Of this phase, however, more will be said later.

GERMINATION.

In order to preserve the desirable qualities which are found in the new-laid egg until it reaches the consumer the development of the chick must be reduced to a minimum. Germination of the fertile egg begins before it leaves the body of the hen and growth of the chick

will continue if the temperature is greater than 68° F.,[1] though, of course, the rate of development is slowed if the temperature is below 103° F. At 86° F. to 91° F. seven or eight days are required to equal three days at the normal heat of incubation. The reverse, however, is true also. If the temperature is somewhat above 103° F., germination proceeds more rapidly. For instance, twenty-four hours at 104° F. to 107° F. gives a chick which is equal in development to one incubated for three days at 103° F.

LOSSES DUE TO INITIAL DELAYS IN MARKETING.

These facts are to be remembered when eggs are left in the sun or held in hot freight cars or stacked in hot rooms. The egg must be kept cool at every stage of its handling if it is to retain a maximum of freshness when it reaches the consumer.[2] This is not a simple matter, even when one considers the great progress made in the extension of artificial refrigeration throughout the country. Refrigerated cars and warehouses, chilled rooms at the commission man's, and the retailer's ice box are, with fair rapidity, making possible a system of handling that will surmount temperature difficulties, *provided the eggs are delivered to the first refrigerator in good condition.* No amount of refrigeration or care will undo the damage done by a few hours of summer sun or a few days in a hot room. Indeed, after deterioration has begun refrigeration is unable to completely check those processes.

The first responsibility for the low quality of market eggs rests upon the farmer, and after him come the country produce dealer or storekeeper and the shipper who does not have artificial refrigeration. Usually the farmer gathers his eggs daily, or he may gather them at irregular intervals. Stolen nests often accumulate a large lay, over a period of some weeks, and may have been covered by brooding hens for a while, to boot, before the farmer happens to find them; but the chances are that every sound-shelled egg goes to market, regardless of the condition inside the shell. If the eggs are gathered with fair regularity, how are they kept while on the farm? Generally where the housewife can most conveniently get them for household use, not where the temperature is low and the air fresh. Neither does the farmer have any regular time for taking this stock of eggs to market. In the spring, when they are most plentiful and the market is falling, he is apt to go weekly or the egg peddler calls at the farm. When hot weather comes and the lay falls off he waits for a larger number or is too busy with "crops" to drive to town. Meanwhile shrinking and incubation are going on rapidly,

[1] Edwards, The Physiological Zero and the Index of Development for the Eggs of the Domestic Fowl. *Gallus domesticus.* Amer. J. Phys., 6: 331–396.

[2] Pennington, Studies of Poultry from the Farm to the Consumer. Bureau of Chemistry Circular 64, p. 33–38.

and, as a last insult to the hen which laid a perfectly fresh egg and the consumer who wants a perfectly fresh egg, he often goes to market with an umbrella over himself, but the basket or box of eggs is exposed to the summer sun, a heat which is often 110° F. and may be 10 degrees or more above that. In the autumn, with a still smaller lay and a rising market, he holds eggs for high winter prices. The conditions under which he keeps them are not conducive to good preservation, and the time is inordinately long. Is it any wonder, with such conditions prevalent on the farm, that studies made in one of the typical western egg-producing States during the candling season showed the following losses on delivery to the packer?

Percentage of eggs constituting a total loss at the packing house.

[Data from 20 shippers, June to November, inclusive.]

Month.	Number of shippers.	Per cent of rots or other total loss.	Number of dozens examined.	Month.	Number of shippers.	Per cent of rots or other total loss.	Number of dozens examined.
June, 2 weeks	12	3.10	5,430	October	5	4.47	1,110
July	19	2.79	13,740	November	2	8.33	210
August	16	3.43	9,270				
September	9	4.03	2,970	Mean	....	4.36	....
				Total	....	....	32,730

The figures in this table give only those eggs which are a total loss. No mention has been made of the stale eggs, dirty eggs, blood rings, and other sources of partial loss. Note that the greatest number of eggs totally lost is in November, when prices to the farmer are very high. In further confirmation of this fact are some investigations of the quality of eggs brought to the country storekeepers during October, showing that only 25 per cent would rank as "firsts" on the Chicago market, 60 per cent were "seconds," due to long holding, 5 per cent were cracked, and 4 per cent were rotten or stuck to the shell from long holding. Some of the farmers at this time had held eggs for four weeks.

FROM THE COUNTRY MERCHANT TO THE PACKING HOUSE.

The country merchant handles eggs as a by-product, taking them in exchange for merchandise. He makes his profits on the merchandise taken in trade, not the eggs, frequently giving an inflated price for them to hold the trade of the desired customer. He, too, is more apt to be careless than careful of them while they are in his possession, storing them in hot or damp quarters and holding for high prices when production is low.

The country merchant and peddler buy eggs "case count," rather than "loss off." Buying "case count" means that a uniform price

is paid per dozen, irrespective of the quality of the eggs. Rots bring just as much as good eggs. Buying "loss off" means that the eggs are candled before payment is made and rotten and broken eggs are returned to the farmer. Occasionally a difference is made between first and second quality eggs.

The farmer usually delivers the eggs to the storekeeper or packer's agent by wagon. From these receivers they commonly go to a central shipping plant, which is generally known as a "packing house," and which handles goods in car lots. This plant may or may not be provided with the proper facilities for doing the work assigned it. To get to the packer, however, the eggs generally go by train and in comparatively small quantities, therefore, as "less than car lots," or what is known to railroad men as "l. c. l's." For such small lots and for short hauls the goods are picked up by a local freight train. The wait at the station, which is frequently only an open platform on which the cases remain until the arrival of the train, is ruinous to quality when the weather is warm.

The haul in the "pick up" freight car, the temperature of which is governed entirely by atmospheric conditions, results in rapid deterioration in summer and oftentimes freezing in winter. Generally the time required for the haul from the agent or storekeeper to the central shipping plant or wholesaler is 24 hours or less. However, it may be longer when the territory drawn upon is large, as in southwestern Kansas or Oklahoma, or when connections with small branch lines are not frequent. Under such circumstances the car becomes an excellent incubator, holding well the sun's heat during the cooler hours of night, and it is not unusual in the summer months for the packer to be greeted by the cheerful "cheep-cheep!" of newly hatched chicks as the cases are carried into his receiving room. This does not mean that atmospheric temperatures are the sole source of incubation. Stolen nests frequently furnish eggs with chicks so well developed that only a short time is needed to hatch them. It does mean, however, great loss from rots and spots and a general loss in freshness.

METHODS OF THE PACKER.

The progressive packer, who generally handles poultry, eggs, and butter, is now equipped with an artificially refrigerated chillroom which maintains a temperature of 40° F. or a little less. If he is wise he rushes the egg cases into that room, stacks them loosely, and chills thoroughly before shipping to his market center. He also candles in a room which is chilled, removing rotten eggs and broken eggs and grading according to cleanliness, size, and, to a certain extent, freshness. After the packer has graded and repacked the eggs in boxes holding 30 dozen each, with clean "fillers"—as the little strawboard

racks which hold the eggs are called—he ships them to the market center, generally in car lots. This gives him a chance to control the temperature of the car, keeping it iced in summer or closing it to prevent freezing if the weather in transit happens to be cold.

REFRIGERATOR CARS.

It is not a difficult matter for the transportation systems to keep egg cars cool enough in summer time to insure quality, provided the eggs are good when they are put aboard the car. But breakage during transit is a serious matter. Freight cars are shunted from siding to siding; air brakes come down hard and the long train jars from engine to caboose, and flying switches may occur while the cars are moving rapidly. These are hard knocks for an eggshell to withstand. Various devices have been and are constantly being tried by the railroads to prevent the shifting of loads, but the breakage of eggs in transit is still discouragingly high to the shipper who loses stock, the railroads which pay claims, and the consumer who ultimately foots the bill for both.

THE END OF THE JOURNEY.

At the end of the railroad haul the eggs usually go to the commission man. If he does business on a large scale in accordance with progressive ideas he, too, has a chillroom in which he holds the stock and recandles it. The wholesaler who does not have such facilities works under a disadvantage both to his own pocket and to the consumer's, because if he buys eggs which have been shipped chilled in a refrigerator car they will "sweat" in his shop—that is, become wet by condensing on their shells atmospheric moisture, which condition hastens decomposition; or he will be compelled to buy eggs shipped without refrigeration, which means more rots, more spots, and more stale, shrunken eggs to be disposed of.

At last we have the egg at the market, a journey of 2,000 miles perhaps, but it is not yet to the consumer. It has still to run the gauntlet of the wholesaler and the retailer and perhaps the storage warehouse. The last time its quality was determined was at the packing house. How has it stood the journey, which probably has required two or three days at least, and may have consumed eight or nine days? In other words, what is the quality of the general run of eggs coming into the city market? The data following throw some light on this point.

Percentage of market grades of eggs coming to New York from nine States and 85 shippers during a period of one year.

Month.	Number of shippers.	Percentage.					Number of dozens examined.
		Rotten.	Cracked.	No. 2.	Dirty.	No. 1.	
1909.							
August	46	3.96	7.94	11.41	15.52	61.17	61,180
September	18	5.29	8.75	14.10	15.44	56.42	18,134
October	9	4.30	7.75	17.05	11.48	59.42	13,361
November	7	4.41	7.34	16.53	10.46	61.26	18,185
December	6	3.05	5.72	16.79	10.23	64.21	8,731
1910.							
January	3	3.99	19.40	5.71	15.83	55.07	840
February	2	1.80	13.94	1.39	14.46	68.41	3,450
March	2	.42	4.02	1.53	3.49	90.54	1,890
April	2	3.48	11.15	5.52	13.74	66.11	2,700
May	3	1.97	6.44	6.13	14.34	71.12	12,510
June	38	3.40	7.30	11.26	13.03	65.01	53,210
July	35	5.63	8.02	14.36	12.98	59.01	64,805
Mean for year		3.48	8.98	10.15	12.58	64.81	
Total number of dozens for the year							258,996
Mean, June to January, 8 months		4.25	9.03	13.40	13.12	60.20	
Total number of dozens, June to January							238,446

Here we have 258,996 dozen eggs—more than a quarter of a million dozens—carefully graded according to commercial standards of New York. These eggs came from nine different States. They were from eighty-five different shippers, and the shipments extended over a period of one year, from August, 1909, to July, 1910, inclusive. The figures refer only to the quality of eggs reaching the market. They are not an index of the comparative numbers received during the different months in the year.

DECREASE IN SUPPLY DUE TO BAD HANDLING.

The heaviest receipts in New York are in the early spring; but at that season the great majority of the eggs are good, hence relatively few are candled. August receipts are not so heavy; but deterioration is so universal that every case must be examined carefully. This fact is emphasized by a trade journal as follows:

The extreme heat that prevailed in most of the western and southwestern sections during August has had a disastrous effect, and a large part of the stock lately arriving here has been badly heated and "burnt," partially hatched, or actually rotten. * * * Naturally under these conditions high-grade eggs have become more and more scarce and the few obtainable have sold well at firm and hardening prices. * * * Some lots from central and southerly western points have shown dead loss in rots and hatched eggs ranging all the

way up to 15 dozen to the case, and many lots, even after throwing out the dead loss, have furnished no eggs at all, or very few, fit for use in a good class of trade, owing to their heated condition.[1]

The percentage of rotten eggs, stale eggs, dirty eggs, and other classes shown in the table are conservative figures for New York's egg receipts. They come from shipments which are above the average, yet 3.48 per cent are rotten and 10.15 per cent are stale, taking the figures for the whole year. It is to be remembered, too, that these eggs were all from shippers in egg-producing districts and were received as fresh eggs, not eggs which had been stored.

When the eggs from the peddler or country storekeeper or the farmer himself were received at the packing house they were candled, and an average of 4.36 per cent of all received from June to November, inclusive, were rotten or had yolks adhering to the shell. Adding this loss to the loss at the market center gives a total loss to the consumer (the statement is made advisedly, because the consumer ultimately pays for all the rotten eggs that go to the dump) of 7.8 per cent of the marketed eggs of the United States. What would it mean to New York City alone in increased supply if these eggs could be saved?

Calculating on the basis of New York's egg receipts, which were 4,256,320 cases, it is seen that the rotten eggs coming to New York in 1909 would amount to 4,443,598 dozens, and about the same number was thrown on the dumps of the packers because they were not fit to ship—nearly 9 million dozens of eggs that New York might have had for food and did not have because of bad handling.

LOSS IN QUALITY AND INCREASE IN PRICE.

Consider, too, the loss in quality of the general supply because the conditions which produced 4 per cent of rotten eggs caused staleness in 13 per cent. Here is a large financial loss, due to bad handling. It costs just the same amount to collect, pack, ship, grade, and market a stale, dirty, or otherwise low-quality egg as it costs to perform a like service for a high-grade egg, though the former must sell for a lower price, and the 5 million dozens of rotten eggs that got to New York represented just as much of an outlay of money as was expended on 5 million dozens of good eggs. The wholesaler, who weeded out the rotten eggs, spread the loss over the rest of the eggs in the lot, and the price to the retailer went up accordingly. Then the retailer increased his price to the consumer, and the consumer, being the last on the list, paid the price and wondered why the cost of living had increased.

The retailer generally has an ice box in which he keeps eggs while marketing. He is not so apt to offend against the principles of good handling as he is to label goods erroneously. The baskets of eggs

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[1] New York Produce Review and American Creamery, Sept. 1, 1909, vol. 28 (No. 19), p. 787.

on his counter labeled "strictly fresh eggs" and "fresh eggs" are more than apt to be practically the same as the basket simply marked "eggs," except for size and cleanliness. The retailer, however, is greatly to blame for wrong ideas concerning "cold-storage" eggs, and this brings us to a general consideration of stored eggs that we may intelligently determine what course the retailer should pursue.

THE COLD STORAGE OF EGGS.

History does not state when mankind first began to put aside eggs during the season of plenty against the time of scarcity, but we may rest assured that it was many centuries ago. They have been put away in lime and in salt, but neither of these substances is satisfactory under commercial conditions, and in waterglass, but this is very little better than lime or salt. Of all the methods known for keeping eggs a cool, fairly dry, even temperature is best. Such a temperature—that is, from 29° to 32° F.—is obtained in the modern cold-storage warehouse, where, in rooms which are scrupulously clean and fresh, eggs are kept from March or April until the following January, or even February, if the winter is severe and fresh stocks come in slowly.

TIME OF STORAGE.

It does not pay to put eggs into cold storage unless they are large, clean, fresh, sound shelled, and well packed. It costs just as much to carry poor eggs as good ones, and poor eggs deteriorate much faster in cold storage than good eggs; hence they are fairly sure to be a losing proposition. The great bulk of the eggs which go into storage are from the early spring lay—the earlier, after the danger from frosting is over, the better. By the latter part of May warm weather is apt to interfere with freshness and high quality, and the comparatively few summer eggs that are stored last must be taken out of storage first if they are to stand well on the market.

Here is a condition of affairs that is directly opposed to the usual point of view of the consumer. If cold-stored eggs are to be used at all, the uninformed buyer demands those in storage for the shortest time, thinking that he will gain quality thereby. Really, the average March or April egg is commonly in better condition in the succeeding December or January than are the eggs stored in June or July. The reason is not far to seek if one remembers the treatment the warm-weather egg gets on its way to market, and the fact that cold is an excellent preservative of freshness in perishable produce provided it goes into the cold chamber in the best of condition.

As stated in the early part of this article, eggs are produced in quantities exceeding the current demands in but a few months of the year, and in comparatively few States, except for home use. During the fall and winter months production practically ceases. At

that time even the farmer buys cold-stored eggs for his own consumption. What would the cities do if it were not for the cold-stored eggs? Let us return to the figures compiled for New York and Jersey City and see how the cold-stored eggs are distributed, when they come in to the warehouses and when they go out to the consumer.

STATISTICS ON STORAGE AND CONSUMPTION.

In March, 1909, New York received 516,141 cases of presumably fresh eggs.[1] Of these, 38,000 cases went into storage and 478,141 were consumed. In April 636,423 cases were received and 412,423 were used, leaving 224,000 cases for storage. In May the receipts were almost as large—603,583 cases, and 235,000 went into the cold stores, leaving 368,583 for consumption. Then in July we find only 37,000 cases stored and 327,955 consumed. In August, instead of putting eggs into storage, 20,000 cases were taken out. Why? Because the good April, or even June, eggs kept in the cold store are better than the so-called fresh-market eggs of August. Listen again to a statement from the article on August eggs before quoted: "Dealers have been obliged to use more of the high-grade storage eggs in order to get enough eggs for the best class of trade."[2]

That is why we drew upon our storage stock in August. In September and October decreasing receipts necessitated greater demands upon it, until finally, in January, 1910, New York received only 137,408 cases, many of which were stored eggs shipped in from western storage houses, and drew upon her own stored supply for 145,000 cases more, practically exhausting it. For that month the consumption of eggs in New York was 282,408 cases; more than half that number—probably two-thirds—were eggs put aside in the season of plenty for the season of shortage, and used during that season, for eggs are not carried in cold storage from one season to another, for the very good reason that they will not keep in sufficiently good condition to be marketable. In January, 1910, the wholesale price of fresh eggs (that is, current receipts) in New York ran from 32 to 42 cents a dozen. Prime western storage eggs, meanwhile, were selling at 26 to 28 cents. More than half of all the eggs consumed in New York were cold stored, yet the retailers assured you that their supplies were "fresh—perfectly fresh—except—well, yes, those small stained eggs in that small basket are storage eggs and, of course, they are lower in price."

THE RETAILER, THE CONSUMER, AND THE COLD-STORED EGG.

Now, what is the truth of this matter? In all likelihood, every egg there was cold stored. The very large, clean, best-order eggs were sorted out and priced as "strictly fresh;" the next most de-

[1] New York Mercantile Exchange.
[2] New York Produce and Creamery Review, Sept. 1, 1909, vol. 28, No. 19.

sirable as "fresh," and so on. In order to sell these for what they were not, a mistaken impression of all stored eggs was given by calling the worst eggs in the shop cold stored. Every man who handled those eggs knew they were cold stored and paid a price in accordance with that fact, except the consumer. The consumer, partly because of ignorance concerning the season of egg production, partly because of prejudice against all cold-stored eggs for all purposes, has allowed the retailer to trade upon his ignorance and prejudice to the great betterment of the retailer's pocketbook. In an age when information is so readily available the consumer is to blame for not knowing more about the subject. Knowing that from November until February egg production has almost ceased, except in the South, and that the market reports 26 to 28 cents a dozen for good storage eggs, does it not follow that the sensible consumer will demand, and get, eggs for about 30 cents a dozen that will fry, scramble, or beat into an omelet in a perfectly satisfactory manner? For soft-boiling or poaching eggs the consumer in the large city must expect to pay from 20 to 40 cents a dozen above the stored-egg price, and even at that figure, because the supply will not go around, he is apt to get eggs that have been held by the farmer until they are really lower in quality than the cold-stored article.

The statement that a cold-stored egg is just as good as a fresh egg is never true. An egg is best when newly laid. Every day causes a loss in eating quality. When environment is bad, one day may render an egg unfit for food; when environment is good, weeks will make so little change that only an expert taster can tell the difference.

SOME REMEDIES FOR EXISTING CONDITIONS.

What can we do to prevent egg deterioration all along the line, thereby giving the consumer a better product and increasing its value to the industry?

IMPROVED CONDITIONS ON THE FARM.

First, the farmer must learn to select good breeds of chickens and take more care of them, that eggs may be larger, cleaner, and more plentiful on the farm. He should also kill off all the mature cocks as soon as the breeding season is over. It is commonly supposed that hens will not lay unless males are present in the flock, but such is not the case. Experiments have shown that flocks without males have produced as many, if not more, eggs than when males were present. When, however, males are present the eggs are fertile, and therefore ready to develop into chicks when temperatures are favorable. Infertile eggs grow stale and shrunken, of course, if held too long, or kept under bad conditions, but they do not form "heated eggs," "blood rings," or the great number of "rots" that come from developing embryos and which account for such a large share of the total losses.

The education which the farmer should have in the gathering and care of eggs after they are laid, and the prompt delivery of them to the next person in the marketing chain, is self-evident from the recital of the farmer's present methods.

CHANGES IN THE METHODS OF THE SMALL BUYER.

The country storekeepers and small produce buyers are, next to the farmer, responsible for the number of low-grade eggs marketed. They must be taught to buy "loss off" instead of "case count" (see p. 467). Buying "case count" places the good farmer and the poor farmer on the same basis, and is grossly unfair to the good farmer. The producer of good eggs receives less and the producer of bad eggs more than they are worth. What incentive is there, on this basis, for the farmer to take extra care and trouble?

The country merchant should be eliminated entirely from egg handling. He likes to buy eggs from the farmer because their value is usually accepted in groceries and merchandise rather than money, and, as has been said previously (p. 467), he makes a profit on his wares if not from the selling of the eggs. Then, too, if the farmer's wife brings in eggs greater in value than the goods she receives in trade her credit on the merchant's ledger insures her continued trading with him. This makes eggs practically a form of currency. Oftentimes from her eggs and poultry a farmer's wife provides her family with clothes and groceries, and it is not at all ususual in small towns for the doctor and dentist to be paid with a due bill on the merchant to whom her eggs have gone, rather than with money.

Frequently the merchant pays the farmer 2 or 3 cents a dozen more than he receives for the eggs when sold by him, thus inflating the price. The merchant recovers his loss on his merchandise and holds the trade of the farmer, but the man who makes a business of buying eggs suffers and so does the townsman who has no eggs to trade, but must pay the same money price for goods that the farmer pays in eggs.

Again, the merchant will buy "case count" rather than "loss off," fearing to offend his patron. Hence, the produce dealer must do the same, because of the scarcity of eggs, close competition, and the farmer's lack of business knowledge. He can not see that he actually loses money at the merchant's.

To prevent the loss in eggs due to the country merchant a cash business on the quality basis should be instituted. Then the small egg merchant could buy "loss off," pay for the eggs in money, and the farmer could purchase his supplies where they are best and most reasonable. If competition were placed where it belongs, among the regular egg buyers, the eggs would go to market more rapidly and in better condition.

Another bad habit which is gaining in the countryside is the leaving at the farm by the packer or merchant of carriers holding 30 dozen. The farmer waits until the case is full before marketing. This is not objectionable when the flock is large or production rapid, but out of season or on the small place it means three or four weeks' holding to get a full 30-dozen box.

BUYING BY QUALITY—NOT BY COUNT.

The shipper can materially improve the quality of eggs in the market if he persistently buys by quality—not simply by count. He will also improve his business. This has been tried sporadically, by a shipper or two, here and there, but all except a few firms have forsaken their guns when shots were most needed—that is, when eggs became scarce or low grade and competition began to be felt. One packer has adhered to a quality basis for 12 years, using four grades. He has built up a business which is good and a reputation which is even better. This reputation prevails not only on the market, where his egg pack is taken without a question, but among the farmers and peddlers who supply him with eggs. His grading is accepted by them and their aim is now not only to see how many eggs they can bring in, but how many of them can be gotten to him as "number ones." Here is a real educator as well as a good business man.

REFRIGERATED RECEIVING STATIONS.

The packer, too, must have artificially refrigerated rooms for handling and holding eggs. Indeed, it seems likely that, as the egg and poultry industry develops, and we must give more attention to the saving of the garnered foodstuffs, there will be numerous receiving stations throughout the country, easy of access and artificially refrigerated, that perishable products in general may be economically handled at the source of production.

CARE AT THE SOURCE OF PRODUCTION.

The source of production. There is the starting point for most of the trouble in the handling of perishable produce, be it southern cotton mishandled in the field before it is baled or western corn that is not well dried before it goes to the elevator, or eggs that are heated or soiled or cracked on the farm. Not all the trouble is at the starting place, of course. Good handling must be everywhere from the producer to the consumer if the maximum of quality and the minimum of loss is to be maintained. But even perfection of handling at the market center can not compensate for bad treatment at the source of supply. The wholesaler is being driven to good equipment and methods because it is economy; the retailer is being forced, little by little, to tell the truth because the strong arm of education and the long arm of the law are both after him. But the farmer, the country merchant, and the small packer are sadly in need of precept and example for the sake of both the producer and the consumer.

APPENDIX.

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PUBLICATIONS OF THE UNITED STATES DEPARTMENT OF AGRICULTURE AND HOW THEY ARE DISTRIBUTED.

By JOS. A. ARNOLD, *Department Editor*.

It is mainly through the issuance and distribution of printed matter that the Department of Agriculture gives effect and practical value to its studies, experiments, and investigations. But the work that the Department can do, and the publications it can print and distribute, are limited by the appropriations made by Congress. In order that, within this limitation, the greatest possible benefit may accrue to the millions of practical farmers, the popular publications—those which tell how to do things—are printed in large editions, and as long as the supply lasts are distributed free to all applicants residing in the United States. The scientific and technical publications, embodying the results of the researches of the Department's scientists and constituting the foundation

of many of the popular publications, are larger in size and necessarily more expensive, and are of great value to scientists engaged in similar lines of work in this and other countries, but are not designed nor suitable for indiscriminate distribution, and hence are issued in comparatively small editions and are not given a wide circulation.[1] This policy is believed to be far better for the Department's constituency as a whole than to scatter broadcast all of the expensive reports and bulletins, which would be of little value to the busy people who actually produce the crops and live stock, and the cost of which would so deplete the printing fund as to leave very little for the printing of popular publications.

The following is a brief outline of the Department's publications—which are mainly of three general classes—and the method of distribution:

1. Publications issued annually, comprising the Yearbook, the Annual Reports of the Department, of the Bureau of Animal Industry, of the Office of Experiment Stations, of the Bureau of Soils, and of the Weather Bureau.

These publications are distributed mainly by Senators, Representatives, and Delegates in Congress, although a limited number of copies is always allotted to the Department. For instance, of the 500,000 copies of the Yearbook the departmental quota is only 30,000, the remaining 470,000 being reserved for distribution by Members of Congress. The Department's supply of publications of this class is reserved almost exclusively for distribution to its officers and special correspondents in return for services rendered, and to libraries, but miscellaneous applicants can usually obtain these documents from some Senator, Representative, or Delegate in Congress.

2. Other departmental reports, bureau bulletins, etc. Of these each main branch of the Department has its separate series, in which the publications are numbered consecutively as issued. They comprise reports and discussions of a scientific or technical character. The Experiment Station Record (monthly) belongs to this class.

The publications of this class are not for distribution by Members of Congress, nor are they issued in editions large enough to warrant free general distribution by the Department. The supply is mainly distributed to small lists of persons who cooperate with or are especially interested in the work of the Bureau, Division, or Office in which the publication originated, or who are rendering some service, and to educational and other public institutions, including libraries. In accordance with a provision in the act of January 12, 1905, editions of publications containing more than 100 pages are restricted to 1,000 copies.

3. The Farmers' Bulletins, circulars, Yearbook extracts, and other popular papers. The publications of this class are written in plain language and treat in a practical way of subjects of particular interest to persons engaged in agriculture and similar pursuits. A special appropriation is made by Congress for the publication of Farmers' Bulletins, and they are issued in large editions and are for free general distribution by the Department.

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[1] A limited number, however, is always provided for distribution to applicants, and copies are sent out in the order in which the requests are received as long as the supply lasts. When no further copies are available and the expense of a reprint can not be incurred, the department is obliged to refer applicants to the Superintendent of Documents, Government Printing Office, who is authorized by the law of January 12, 1895, to sell them, as well as all Government publications, at a nominal price. The distribution of the publications is thus indefinitely continued after the Department is no longer able to supply the publications and without expense to the Government.

The Farmers' Bulletins are also for distribution by Senators, Representatives, and Delegates in Congress, each of whom is furnished annually, according to law, with a quota of several thousand copies for distribution to his constituents. Four-fifths of all such bulletins printed with the amount specially appropriated for the purpose are distributed in this way, leaving only one-fifth of them for distribution by the Secretary. It is frequently necessary to refer applicants for these publications in quantities to their Senators, Representatives, or Delegates in Congress because of the insufficiency of the Department's allotment to supply the large and increasing demands for the bulletins.

A limited supply of nearly all of the publications in classes 1 and 2 is, in compliance with the law, placed in the hands of the Superintendent of Documents, Government Printing Office, for sale at a price fixed by him. He is authorized by law to issue, with the approval of the Secretary, new editions of Department publications so long as the demand for them continues, the proceeds of the sales being used to pay for reprints. Applications for these classes of publications should be addressed to the Superintendent of Documents, Government Printing Office, Washington, D. C., accompanied by cash, postal money order, express order, or draft covering the amount of the charge. No postage stamps or private checks should be sent.

The Secretary of Agriculture has no voice in designating the public libraries in which shall be deposited all public documents. These libraries are designated by Members of Congress and the distribution of public documents to such depositories, including the publications of this and all other Departments of the Government, is a function of the Superintendent of Documents. The Department maintains a list of libraries, which are not public depositories, to which the publications of the department are sent as issued. All publications of the Department are, therefore, readily available for reference in almost every library in the United States.

The Department has no list of persons to whom all publications are sent, as this method of distribution was long ago found to be wasteful and unsatisfactory. The Monthly List, dated the last day of each month, and containing full information with regard to the publications issued that month, and how the same may be obtained, will be mailed regularly to all who apply for it. The Department also issues and sends to all who apply for them lists of the available publications of the various Bureaus, Divisions, and Offices.

Publications of the State agricultural experiment stations are not for distribution by the United States Department of Agriculture. Applications for them should be addressed to the directors of the respective stations.

REVIEW OF WEATHER CONDITIONS OF THE YEAR 1910.

By P. C. Day, *Chief of Climatological Division, Weather Bureau.*

The following weather summary of the year 1910 is compiled according to the plan by which the National Weather Bulletin is published; that is, by months for the first three and the last three months, but by weeks, ending with Monday, from April to September, inclusive.

The most remarkable meteorological feature of 1910 was the abnormality of the spring. Over nearly the entire country March was very warm and generally dry, and was followed by a long period of cool and rather wet weather. There was much resemblance between the spring of 1910 and that of 1907; but in 1907 the premature warmth was practically confined to the latter half of March and was promptly followed by a long period of decidedly cool weather,

accompanied in the southeastern States by abnormally heavy rains. In 1910 the unusual warmth prevailed during nearly the whole of March, and continued in the greater portion of the districts to the westward of the Rocky Mountains practically without a break through April and May to about the middle of June. Also in most districts east of the Rockies the warmth prevailed till about the middle of April, when unseasonably cool weather followed, lasting generally till about the middle of June.

The cool period of the spring of 1910 was generally accompanied by more than the normal precipitation, though very few stations received enough to counterbalance the accumulated deficiency due to the generally dry weather of March and early April. Indeed, in the more northern States from the upper Lake region westward to the one hundredth meridian, or somewhat beyond, dry weather prevailed practically all through the spring and summer; only a very few weeks brought considerable rains, and long, dry periods intervened, causing the soil to become far too dry for normal crop growth. Minnesota and North Dakota were probably the States most seriously affected by this drought, but large portions of Wisconsin and South Dakota suffered severely. For the period from March 1 to May 9, ten weeks of very great importance to crops, St. Paul received only one-sixth of its normal precipitation, Duluth about two-fifths, Moorhead slightly more than one-half, and Bismarck but little more than one-third. Considering the five months from March to July, inclusive, we find that St. Paul and Moorhead had each less than 5 inches, or only about the third part of the usual amounts; Duluth received but 7 inches and Bismarck less than 6, or only about half the normal falls. When August and September are included, making seven months, St. Paul and Moorhead are found to have less than 8 inches each, or hardly more than one-third the normal amounts, while Duluth and Bismarck had only about two-thirds of their normal amounts.

January.

January, 1910, opened with mild weather prevailing in most eastern districts, but a decided fall in temperature soon occurred, and the first half of the month averaged colder than usual in nearly all parts of the country. The last half of the month was unseasonably warm in all districts east of the Rocky Mountains except the South Atlantic and Gulf States, but west of the Rockies the cold weather lasted longer, especially in Nevada and California.

The precipitation averaged more than normal in most of New England, the Middle Atlantic States, lower Lake region, and Ohio Valley, also in eastern Kansas, northern Arizona, western Washington, and much of Wyoming. In some central States and in portions of the Plains region there was a greater snowfall than usual, and Iowa, Minnesota, and South Dakota had deep snow covering the ground for nearly or quite the whole month. The greater part of the country had less precipitation than usual, and this was especially true of the cotton region, where there was a general deficiency of from 1 to 2 inches.

February.

Over almost the entire country February averaged somewhat colder than normal. This was notably true of the Mississippi Valley and the northern tier of States, which, however, experienced rather mild weather during the first half of the month. A severe cold wave swept over the Mississippi Valley and Gulf States about the 15th to 19th. As the month drew to a close remarkably mild weather set in over the Gulf and Atlantic States.

The precipitation was greater than normal in most of the Ohio Valley, New York, and New England, where the snowfall was rather heavy; and Louisiana

and most of the east Gulf coast received very heavy rains. In general, nearly all the region to eastward of the Mississippi had more than normal precipitation, excepting Maryland, the Virginias, northern and western North Carolina, and eastern Tennessee, northern Illinois, and the upper Lake region. West of the Mississippi the month was drier than usual, save in Louisiana and Arkansas, in parts of Oregon, and generally in the northern border States from Washington to North Dakota.

March.

Except in southern Florida the month averaged warmer than normal, and generally in a marked degree. In most of Idaho, Nevada, and Utah, and everywhere between the Rockies and the Appalachians, save in the southern tier of States, the excess of temperature was at least 8°, and in Minnesota and the upper Missouri Valley it was from 16° to over 20°, the most phenomenal conditions being in North Dakota, where the average temperature usual for March is about 21°, or about 11° below freezing, but March, 1910, had an average temperature of over 41°. The mild conditions prevailed with scarcely a break during the entire month. The period from the 21st to 29th generally marked the culmination of the warmth in districts to eastward of the Rocky Mountains.

Almost as extraordinary as the warmth of March. 1910, was the dryness of the same month, which normally is one of the wettest of the year over very large and important areas. March of 1910 brought as much precipitation as usual only in a few widely scattered districts, chiefly in the Florida peninsula, central California, Arizona, northern Idaho, and parts of Montana, Wyoming, and the Dakotas. The deficiency in precipitation was very notable in the Lake region, the Mississippi and Ohio valleys, the interior portions of the Gulf States, and generally along the Atlantic coast.

The Crop Season, April-September—Summary by Weeks.

The opening days of April were generally marked by warm and dry weather, although comparatively cool weather visited the Ohio Valley and Lake region, while rains occurred in much of Texas and the middle Mississippi Valley, also on the North Pacific coast.

By weeks, ending with Monday, from April 11 to October 3, the weather conditions may be summarized as follows:

April 11.—Generally a remarkably warm week. Cool weather for the season prevailed only in southern Florida, New Mexico, and western Texas, and in western Washington. In the upper Missouri and Mississippi valleys the abnormal warmth was most marked, North Dakota temperatures averaging about 16° above normal.

The precipitation was practically confined to New England and northeastern New York, the vicinity of Lake Erie, the State of Washington, northern Idaho, and western Oregon, and especially a broad strip covering southern and eastern Texas and extending thence northeastward over Arkansas, Missouri, eastern Iowa, and Wisconsin, to upper Michigan, and including portions of adjoining States.

April 18.—The week was decidedly warm in the Lake region and central California, and warmer than normal generally to eastward of the Mississippi River, in Louisiana, and central and eastern Texas, and in the Pacific States and the northern portion of the Plateau and Rocky Mountain regions; but it averaged cooler than normal from New Mexico and Arizona northeastward to Minnesota and eastern North Dakota.

The rainfall was decidedly heavy in Virginia and parts of Maryland and North Carolina, also in most of the middle Mississippi and lower Ohio valleys. There was considerable rain in nearly all districts east of the Rockies, the chief exceptions being New England and New York, Florida, Nebraska, and most of Texas. In a large number of States this rain was highly beneficial, following, as it did, a long period of dry weather. West of the Rockies there was scarcely any precipitation.

April 25.—Remarkably mild weather prevailed to westward of the Rocky Mountains, especially in Montana, Idaho, Oregon, California, and Nevada. At many stations the highest temperatures ever known in April were recorded. Also in Vermont and New Hampshire and adjoining portions of other States the week averaged far warmer than normal. In marked contrast were the conditions in the central portion of the country, where the temperature was deficient and generally very much so. At many stations in the middle and lower Mississippi Valley and the Gulf States the lowest temperatures yet recorded at this season of the year occurred. Freezing weather visited the entire Ohio and upper and middle Mississippi valleys and even the northern portions of Alabama, Mississippi, and Arkansas. Immense damage resulted to fruit and vegetation, especially as the preceding warm weather had brought them to very advanced stages of development.

The precipitation of the week fell chiefly to eastward of the Mississippi River and to northward of Tennessee and South Carolina. Considerable snow fell in the Lake region, and even as far south as central Alabama and northern Arkansas there were snow flurries.

May 2.—The week averaged cooler than normal in the South Atlantic and Gulf States as far westward as central Texas, and north to southern Missouri and the Ohio River. In the remainder of the country the week was generally marked by warm weather.

Considerable rain and some snow fell in Wyoming and over large portions of the adjoining States, and beneficial showers visited portions of Oregon. In eastern Iowa and over the greater portions of Kansas and Missouri good showers fell, and in portions of Tennessee and North Carolina and in most of the States to northward and northeastward of them there was ample precipitation.

May 9.—The week averaged warmer than normal over most of the country west of the Rockies, also along the Gulf coast. Otherwise, it was generally an abnormally cold week, especially in Missouri and the surrounding States; at several stations in Missouri, Illinois, and Kansas the mean temperature was from 10° to 12° lower than usual at this season.

Quite heavy rains fell in the lower Missouri Valley and in North Carolina and western South Carolina, and nearly all districts east of the Mississippi River had fair rainfall save the upper Lake region and most of the Gulf States. There was practically no precipitation in the upper Mississippi and upper Missouri valleys or in the far Southwest.

May 16.—The week averaged warmer than normal almost everywhere west of the Rockies, also generally in Texas; but it was a cool week in most other districts, especially in the Ohio Valley and lower Lake region.

The week was notably dry in the upper Lake region and over most of the Gulf States, but southeastern Florida and northern and northwestern Texas had rather heavy rains. There were good rains in the Ohio and middle Mississippi valleys, also in Oklahoma and large portions of adjoining States, and in parts of Oregon and generally in the northern border States from Washington to North Dakota.

May 23.—The week was warmer than usual in the Pacific States, and generally in the Lake region and along the immediate Atlantic coast. Otherwise it was, for the most part, a cool week, especially in the Dakotas, Nebraska, Kansas, Colorado, New Mexico, and northwestern Texas.

The Mississippi Valley received ample rain, also eastern Kansas, nearly all of Oklahoma and Texas, and the eastern portions of Colorado and Wyoming. East of the Mississippi there was at least a fair rainfall save in northern New England, Florida, and the immediate South Atlantic coast. In considerable portions of Louisiana and eastern Texas the falls were excessive, many stations reporting over 8 inches.

May 30.—Again cool weather prevailed in the central portion of the country, notably in Illinois, Indiana, and adjacent States. The week averaged slightly warmer than normal along the Atlantic coast and in western Texas, and decidedly warmer west of the Rockies, especially in Nevada, where the highest temperatures ever recorded during May occurred as the week closed.

Again most parts of the Plains States and the region eastward to the Atlantic received ample rains, the chief exceptions being the upper Mississippi Valley and the Dakotas, and the greater part of Texas. West of the Rockies it was a very dry week, save in Washington, northern Idaho, and adjoining parts of Montana and Oregon, where some good rains fell.

June 6.—In the cotton region the week averaged not far from normal as to temperature, but almost everywhere to the northward, from the Atlantic to the Rockies or beyond, it was a remarkably cool week for the season, especially in the Lake region and the upper Ohio Valley, where many stations reported average temperatures 16° or more below the normal. However, in western Texas and in Arizona, Nevada, and Utah it was a notably hot week.

In Louisiana, Arkansas, and most of Missouri and eastern Texas, also in most districts east of the Mississippi, there was considerable rain; but very little fell in the Florida Peninsula, the central portions of Ohio, Indiana, and Illinois, and in most of the upper Mississippi Valley. In regions to the westward of those already named the week was almost everywhere a dry one, especially beyond the Rocky Mountains.

June 13.—In most districts west of the Rockies the week was warmer than normal, but to the eastward abnormally cool weather was again the rule, notably in the lower Lake region, the Ohio Valley, and the State of Missouri.

In the upper Lake region and again in the upper Mississippi Valley there was practically no rain, also in the greater part of Texas and the western portions of Kansas and Nebraska. Almost everywhere else east of the Rockies it was a rainy week. Parts of Missouri, Florida, Georgia, and the Carolinas received quite heavy falls. In the far West, the coast regions of Oregon and Washington and parts of Montana had good rains.

June 20.—Near the beginning of the week a decided change of conditions in the Missouri and upper Mississippi valleys and the Lake region took place, and notably warm weather prevailed, although to the southeastward the warmth did not arrive till near the close of the week. In the Pacific States and Arizona there was likewise a reversal of the conditions of many preceding weeks, and cool weather for the season prevailed, especially in the interior of California.

In the Atlantic States and West Virginia there was considerable rain, and floods caused much damage from the Potomac River southward to South Carolina. In the remainder of the country rain was practically confined to parts of Washington, Oregon, Idaho, Montana, the lower Mississippi Valley, and eastern Kansas. Much need of rain was now felt in the Dakotas, Minnesota, Wisconsin, and parts of Iowa and Texas.

June 27.—Nearly everywhere west of the Rockies, also in the cotton region, save Oklahoma and the interior of Texas, the week was cooler than normal. Elsewhere it was warmer, and very decidedly so in Minnesota and the adjoining States.

There was abundant rain in nearly all parts of the cotton region; elsewhere good rains fell chiefly in Missouri and central Illinois, extreme western Texas, and over parts of Kansas, Nebraska, South Dakota, Minnesota, and Iowa.

July 4.—Temperatures below normal continued in most of the cotton region, save in Texas and Oklahoma, and beyond the Rockies, except in Idaho. Elsewhere the week was warmer than normal, notably along the northern border from Lake Superior to Montana.

Most of Oklahoma and parts of Texas and North Carolina received no rain or but very little, and felt much need of moisture. The cotton region otherwise had abundant rainfall, large portions getting very heavy rains, especially parts of Louisiana and Alabama. In the latter State there were damaging freshets. The Ohio Valley and the southern parts of Illinois and Missouri received much rain, but elsewhere the amounts were small, except that fair amounts occurred in southern Colorado and regions roundabout, in Montana and parts of North Dakota, and in a few other localities. Drought still continued over the greater part of the spring wheat growing section.

July 11.—Weather warmer than normal was the rule to the eastward of the Mississippi, in most of Texas, and the far Southwest, and especially in the Pacific States, while it was cooler than the average from the lower Mississippi Valley northwestward to the northern Rocky Mountain region.

In most of Minnesota and parts of the Dakotas and eastern Nebraska there was considerable rain, but the chief region of rainfall covered the Ohio Valley, central and southern Missouri, and practically all districts to southward, also much of Kansas, southern Oklahoma, eastern, northern, and the Panhandle of Texas. There was but little rain from Iowa and Wisconsin eastward to New England and practically none to the westward of the Rocky Mountains.

July 18.—Warm weather prevailed in the Atlantic coast States and generally in the Plains States and to the westward, especially in Montana, Wyoming, and Idaho.

Large portions of Arizona, Nevada, and southern Utah received beneficial showers. Good rains occurred in portions of the Dakotas, Nebraska, and Texas; and practically all of Kansas, Oklahoma, Missouri, Arkansas, Louisiana, and, with a few exceptions, the States to eastward of the Mississippi River received ample rainfall. In eastern Missouri, southern Illinois, and most of Indiana and Kentucky, the precipitation was very heavy and much damage resulted. In part of New York the long drought was broken, but much of the eastern portion of the State still felt great need of rain. Also the greater parts of Michigan, South Dakota, and Minnesota and practically all of North Dakota and Wisconsin received but little rain and were now suffering from long-continued dryness.

July 25.—This week was warmer than normal in the Lake region and generally to the westward of the Mississippi, especially in Nevada and Utah and parts of adjoining States. Cool weather was the rule in most of the cotton region, especially in the Carolinas, Georgia, and Virginia.

The rainfall was generally ample in the Lake region, and northern Minnesota and parts of the Dakotas had considerable rain. Locally heavy precipitation occurred along the Gulf and south Atlantic coasts from eastern Texas to North Carolina. Save a few scattered regions, the rest of the country received very little or no rain.

August 1.—Hot weather prevailed in Kansas, Oklahoma, and northwestern Texas, and generally the week was warmer than normal, except in the Lake region, Arizona, and over the Pacific coast region.

Heavy precipitation occurred in northeastern Colorado, and considerable amounts occurred in other parts of that State and in the northern portions of Arizona and New Mexico. Parts of the central and eastern Gulf States had much rain, and portions of North Carolina, Tennessee, Arkansas, central Iowa, northeastern Missouri, and the larger part of the Ohio Valley had ample falls, also northern Virginia and large portions of the States to northeastward of it. Parts of Kentucky received damagingly excessive rains.

August 8.—Warm weather prevailed in the cotton region, especially in the interior of Texas; but for nearly all the rest of the country the week was comparatively cool for the season.

No rain fell in much the larger portion of Texas; but otherwise the cotton region received ample rain, also practically all parts of Kansas, Nebraska, and Missouri. Elsewhere there was rain in considerable portions of Arizona, New Mexico, Colorado, and South Dakota, in upper Michigan, and in New York and New England, especially the northern portions.

August 15.—Warmer weather than normal prevailed in the Lake region, along the Gulf coast, in New Mexico, and especially in the interior of Texas, but the week was generally cool throughout the entire central portions of the country from the Atlantic to the Pacific.

Ample rain fell in practically all parts of the South Atlantic and Gulf States, save Texas, where only the northern portion received any appreciable amounts. Much of Arkansas had heavy rain, and there was considerable in northern Arizona and New Mexico and thence eastward and northeastward through Colorado, Oklahoma, Kansas, Nebraska, the eastern parts of South Dakota and Minnesota, and the western parts of Iowa and Wisconsin. Also portions of New York, southern New England, and substantially all of Pennsylvania had good rains. At the end of the week much need of moisture was felt in parts of New York and New England, Maryland and Ohio, southern Michigan and eastern Iowa, and the larger part of Texas.

August 22.—The week was warmer than normal except in the Atlantic and Pacific States and the northern Rocky Mountain region.

Abundant rainfall occurred in most of Oklahoma, Kansas, and Nebraska, generally in the Ohio, upper Mississippi, and lower Missouri valleys, and in nearly all parts of the Atlantic and Gulf States, save western New York and Pennsylvania, the northern portions of Georgia and Alabama and over much of Texas. In the latter State the drought was well broken in some counties, though little rain fell in the central part of the State and practically none in the Rio Grande Valley.

August 29.—Cool weather for the season prevailed in the Ohio Valley and in the northern half of the country west of the Mississippi River, where a drop of temperature remarkable for August caused readings as low as 26° at several stations in Montana and Wyoming. Damaging frosts occurred in those States and in parts of Idaho and the Dakotas, and light frosts in many other States.

Rain fell in the coast districts from New Jersey to Louisiana, in the lower Mississippi Valley and over most of the Ohio Valley and Lake region, being especially heavy in the vicinity of Lake Michigan, and in a small area of southeastern Nebraska, where very heavy rain—over 8 inches at one station—occurred during a single night. Only light rains occurred in other districts.

September 5.—Abnormally cool weather lasted throughout the week in Montana and Idaho, and the upper Lake region and the northern half of the country to the westward of the Mississippi had rather cool weather for the season.

In marked contrast were the conditions in Arkansas, Oklahoma, and the interior of Texas, where unseasonably hot weather prevailed.

Heavy rainfall occurred in central Missouri and parts of the Carolinas, and there was ample rain practically everywhere to the eastward of the Mississippi River, also between the Missouri and Mississippi rivers, and in Kansas and portions of Oklahoma and Arkansas, over the coast regions of Louisiana and Texas, and in western Montana and northern Idaho.

September 12.—Again cool weather prevailed in the northern States west of the Mississippi, especially in North Dakota, Montana, northern Idaho, and the eastern portions of Oregon and Washington. Light to killing frosts were reported from many States, but the damage was very slight save in a few cases. In the southern and eastern parts of the country the weather almost everywhere averaged warmer than normal.

To the eastward of the Mississippi River and north of the Ohio River and Maryland there was generally ample rainfall. Elsewhere good rains occurred in most of North Dakota, northern Minnesota, Missouri, Oklahoma, and eastern Kansas, in parts of the Carolinas, Florida, southern Mississippi, and eastern Louisiana, and in a large portion of Texas, though considerable areas of the latter State were left still suffering from drought.

September 19.—In most of Oregon and northern California the week was marked by cool weather; otherwise warmer weather than normal prevailed near and to the westward of the Mississippi River. In the eastern States the average temperature was below normal.

In nearly all parts of the Pacific States, Idaho, and Nevada, and in much of Utah and Arizona considerable rain fell; in much of this region it was the first important rain during several months. To the eastward of the Rockies the week was generally a dry one. However, good rains occurred in much of Iowa, around Lake Michigan, in the Ohio Valley save the lower portion, in parts of Maine, New Hampshire, Florida, and eastern North Carolina, and notably in central and southern Texas, points in the lower Rio Grande Valley receiving over 9 inches.

September 26.—Along most of the northern border the week averaged cooler than normal, but for the rest of the country it was generally an unseasonably warm week, especially in Oklahoma, Arkansas, and adjoining States.

Throughout most of the northern half of the country between the Rockies and the Appalachians there was an abundance of rain, and excessive falls occurred in parts of Kentucky and the lower Missouri Valley. In the remainder of the country there was very little rain, save in southwestern Alabama and the southern portions of Mississippi and Louisiana.

October 3.—Almost everywhere the week was warmer than normal, the excess of temperature being very marked in the Plains States and the lower Mississippi Valley.

In northern and western Oregon and especially in Washington quite heavy rains occurred. Otherwise the week was almost everywhere a very dry one. The chief exceptions were an area stretching from eastern Nebraska northeastward to Lake Superior and northern Lake Michigan, the central portions of Arkansas and Oklahoma, South Carolina, and most of Georgia and eastern Florida. Generally in the Virginias and the States to the northeastward much inconvenience was now felt from the lack of water.

Review of the Season.

For the period from March 1 to September 30 the mean temperature was practically everywhere above normal, save along the immediate north Pacific coast and in the extreme southern part of Florida. The excess was generally

from 3° to 5° in the upper Lake region, upper Mississippi and middle and upper Missouri Valleys, northern and middle Rocky Mountain and middle plateau regions, and in western Texas; elsewhere the excess was generally less than 3°. The unusual warmth of March was the great factor in causing the temperature excess, and many districts had, after the 1st of April, a cooler season than normal, notably the Ohio and middle Mississippi Valleys.

Over much the greater part of the country the precipitation of the crop season was deficient. The deficiency was from 8 to 12 inches, or somewhat greater, in central and northern Texas, in Oklahoma, Nebraska, Iowa, Minnesota, northern Missouri, western Wisconsin, and the eastern portions of the Dakotas, along the central Gulf coast, in portions of the Florida peninsula, and in central Georgia, in the upper Ohio Valley, and on Long Island and in its vicinity. By contrast the precipitation was in excess by 10 inches or more in parts of central and northeastern Kentucky and central Missouri and in a few other localities; and in general it was greater than normal in nearly all of Kentucky and southern Illinois, central and southeastern Missouri, the greater part of Arkansas, and portions of several adjoining States; also in eastern North Carolina and in the southern coast regions of Texas.

October.

The month averaged warmer than normal in nearly all portions of the country, and was especially mild in the upper Missouri Valley. There were a few cool spells in some portions, and as the month was ending a marked cold wave swept over practically all districts to eastward of the Rockies, bringing very unseasonable cold in the lower Mississippi Valley, east Gulf, and South Atlantic States.

In eastern North Carolina the precipitation was less than normal, but otherwise the Atlantic coast States from Florida to New Jersey received more than the normal amounts, owing chiefly to the tropical hurricane which passed northeastward about the 15th to 20th, bringing high winds and exceedingly heavy rain to the Florida peninsula. Most of the cotton region had more than normal precipitation, but there was a deficiency in northern Louisiana, central and northeastern Texas, and most of Oklahoma. Very heavy rains occurred early in the month in western Tennessee, northeastern Arkansas, and the lower Ohio Valley, resulting in much damage. In the lower Lake region, southern California, the central plateau, and northern Rocky Mountain regions and over the north Pacific coast the amounts were generally greater than normal. In New England and the central portions of New York and Pennsylvania the rainfall was decidedly scanty; also the Missouri and upper Mississippi Valleys had very deficient precipitation.

November.

West of the Mississippi Valley November generally averaged warmer than normal, especially in Colorado and adjoining States. In the eastern part of the country the month was colder than usual, though the period from the 20th to 28th was marked by rather mild weather between the Mississippi River and the Appalachians.

In central and southern California the month was unusually dry, but elsewhere west of the Rocky Mountains there was more precipitation than normal, especially in the western portion of Oregon. East of the Rockies, save over small areas, the month was everywhere drier than normal, and notably so in the Mississippi, lower Missouri, and Ohio Valleys and portions of the middle Atlantic and west Gulf States, where the deficiency ranged very generally from 2 to 4 inches.

December.

To the westward of the Mississippi Valley, except in portions of North Dakota and Montana, December was generally warmer than normal, but to the eastward it was generally much colder, especially in the Ohio Valley, lower Lake region, and Middle Atlantic States, where it was one of the coldest Decembers in many years, although there were no unusually low temperatures. During the first days of the month a severe cold spell visited the East Gulf and South Atlantic States, the line of freezing weather extending to the Gulf coast and well into the southern portion of the Florida Peninsula. The mildest weather of the month in most Eastern States occurred during the last ten days.

Taking the country as a whole the December precipitation was notably less than usual; although in several widely scattered areas it was somewhat greater, but save one, covering portions of eastern Texas, southeastern Arkansas, and most of Louisiana, these areas were comparatively small and unimportant. In a large number of Northern States there was more snow than usual, but so little rain fell that the precipitation as a whole was deficient. At the close of the month marked need of rain was reported in New England, Iowa, Oklahoma, New Mexico, and California, and there was a general and widespread deficiency in the fall for the year as a whole. Large areas in New England did not receive more than 75 per cent of the usual fall, and in portions of the upper Mississippi and Missouri valleys the total fall for the year did not reach 50 per cent, and similar conditions existed in portions of Texas, the Southwest, California, and other smaller areas.

SEEDTIME AND HARVEST—AVERAGE DATES OF PLANTING AND HARVESTING IN THE UNITED STATES.

By J. R. Covert, *Bureau of Statistics.*

Unaffected by the rapid expansion of areas under cultivation, the reclamation of waste land, the invention of labor-saving machinery, and the increasing effectiveness of human labor as applied to agriculture, the dependence of man and beast upon seedtime and harvest continues unceasingly. As popularly applied, these terms are descriptive of local phases of agriculture, yet from a world viewpoint these operations are continuous and unending. Mankind is somewhere busy all seasons at one or the other; indeed, at both.

The value to agriculture of the science of meteorology, of a knowledge of how properly to prepare the seed bed, to select pure-bred viable seed, and the advantage gained by the adoption of suitable cultural methods, are freely acknowledged, and popular interest in these subjects is increasing by leaps and bounds; but comprehensive information concerning the progress of sowing and harvesting, as these great waves of agricultural activity annually sweep over the land, is limited, notwithstanding the widespread collection and coordination of agricultural statistics.

Recognizing the fact that reliable information regarding this phase of agriculture would be of perpetual usefulness, a world-wide inquiry was prepared by the Bureau of Statistics, Department of Agriculture, and addressed to thousands of practical and intelligent farmers, to agricultural teachers, and to experiment stations.

Each correspondent in the United States was requested to give information based upon personal knowledge concerning the usual date of planting and harvesting in his community. These correspondents—many thousands in number and resident in every agricultural county of the United States—were selected because of special qualifications for supplying such information. A schedule containing a series of questions covering about 40 staple crops was mailed to each.

METHODS OF COMPILATION.

The fundamental basis of this article, therefore, is the individual returns of correspondents, each of whom was requested to report for his own community, because the community is a popular unit, one with which each correspondent is familiar, and in relation to which he is accepted as an authority.

Obviously the correct basis of a classification or grouping of answers to inquiries such as this is the climate, which, of course, involves consideration of

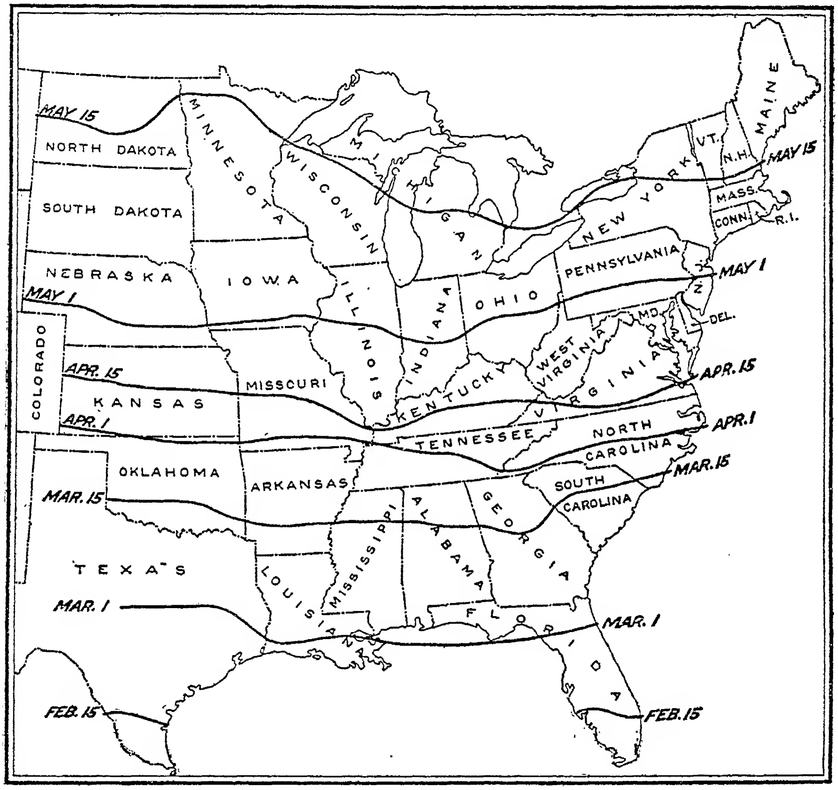

FIG. 31.—Lines of average dates of the beginning of field-corn planting.

soil, rainfall, altitude, exposure, and latitude. Lack of space and want of data prevent the grouping of answers on so technical a basis. Under the circumstances the most practicable method is a grouping of individual returns, county by county, as the first step toward obtaining a State mean which will represent, approximately, the time when given farm operations, such as planting and harvesting corn, begins, when it is general, and when it ends.

Mean date for specified crops, with distinction of beginning, general, and ending, by States.

SOWING OR PLANTING.

State.	Winter wheat.			Winter rye.			Fall-sown barley.		
	Beginning.	General.	Ending.	Beginning.	General.	Ending.	Beginning.	General.	Ending.
Ala.	Oct. 4	Oct. 27	Nov. 22						
Ark.	Sept. 22	Oct. 11	Nov. 6						
Conn.				Sept. 6	Sept. 24	Oct. 16			
Del.	Oct. 3	Oct. 10	Oct. 26						
Ga.	Oct. 14	Nov. 5	Nov. 28	Sept. 17	Oct. 10	Nov. 10			
Ill.	Sept. 12	Sept. 24	Oct. 8	Sept. 5	Sept. 18	Oct. 5			
Ind.	Sept. 8	Sept. 21	Oct. 7	Sept. 2	Sept. 15	Oct. 2	Sept. 10	Sept. 22	Oct. 6
Iowa.	Sept. 4	Sept. 15	Sept. 27	Sept. 7	Sept. 19	Oct. 3			
Kans.	Sept. 11	Sept. 26	Oct. 24	Sept. 2	Sept. 19	Oct. 4			
Ky.	Sept. 19	Oct. 5	Oct. 25	Sept. 6	Sept. 25	Oct. 19	Sept. 9	Sept. 27	Oct. 12
Md.	Sept. 18	Oct. 1	Oct. 20	Sept. 11	Sept. 25	Oct. 11			
Mass.				Aug. 28	Sept. 14	Oct. 4			
Mich.	Sept. 3	Sept. 14	Sept. 26	Sept. 6	Sept. 26	Oct. 9			
Minn.	Sept. 3	Sept. 12	Sept. 21	Sept. 3	Sept. 13	Sept. 25			
Mo.	Sept. 9	Sept. 23	Oct. 10	Sept. 3	Sept. 18	Oct. 6			
Nebr.	Sept. 5	Sept. 17	Oct. 6	Sept. 7	Sept. 22	Oct. 2			
N. J.	Sept. 12	Sept. 24	Oct. 8	Sept. 9	Sept. 23	Oct. 14			
N. Y.	Sept. 4	Sept. 18	Oct. 2	Sept. 5	Sept. 19	Oct. 6			
N. C.	Oct. 14	Oct. 26	Nov. 15	Sept. 8	Sept. 30	Oct. 26			
Ohio.	Sept. 11	Sept. 24	Oct. 10	Sept. 9	Sept. 22	Oct. 6	Sept. 8	Sept. 14	Sept. 24
Okla.	Sept. 13	Oct. 2	Oct. 29	Sept. 5	Sept. 22	Oct. 15			
Pa.	Sept. 2	Sept. 15	Oct. 4	Sept. 11	Sept. 24	Oct. 13			
R. I.				Sept. 6	Oct. 6	Oct. 25			
S. C.	Oct. 13	Nov. 5	Dec. 8	Sept. 22	Oct. 20	Nov. 27			
S. Dak.	Aug. 31	Sept. 16	Oct. 10	Sept. 6	Sept. 18	Sept. 30			
Tenn.	Sept. 22	Oct. 10	Nov. 14						
Tex.	Sept. 28	Oct. 20	Nov. 16	Sept. 16	Oct. 1	Oct. 24	Sept. 30	Oct. 20	Nov. 8
Vt.	Aug. 7	Aug. 27	Sept. 8	Aug. 25	Sept. 15	Oct. 10			
Va.	Sept. 20	Oct. 3	Oct. 21	Sept. 13	Oct. 2	Oct. 22			
W. Va.	Sept. 15	Sept. 28	Oct. 15	Sept. 13	Sept. 22	Oct. 15			
Wis.	Sept. 5	Sept. 14	Sept. 25	Sept. 11	Sept. 21	Oct. 2			

State.	Fall-sown oats.			Spring wheat.			Spring-sown oats.		
	Beginning.	General.	Ending.	Beginning.	General.	Ending.	Beginning.	General.	Ending.
Ala.	Oct. 6	Oct. 24	Nov. 13				Jan. 31	Feb. 20	Mar. 9
Ark.							Feb. 15	Mar. 1	Mar. 18
Conn.							Apr. 9	Apr. 22	May 8
Fla.	Oct. 11	Nov. 6	Nov. 24						
Ga.	Oct. 2	Oct. 26	Nov. 19				Feb. 6	Feb. 27	Mar. 16
Ill.				Mar. 22	Apr. 1	Apr. 9	Mar. 19	Mar. 31	Apr. 14
Ind.							Mar. 20	Apr. 4	Apr. 18
Iowa.				Mar. 29	Apr. 6	Apr. 14	Apr. 3	Apr. 11	Apr. 22
Kans.				Feb. 27	Mar. 13	Mar. 27	Mar. 7	Mar. 21	Apr. 3
Ky.							Mar. 8	Mar. 23	Apr. 11
La.	Oct. 16	Nov. 5	Nov. 22						
Me.							May 2	May 13	June 1
Md.							Mar. 20	Apr. 1	Apr. 21
Mass.							Apr. 10	Apr. 27	May 6
Mich.				Apr. 23	May 3	May 14	Apr. 20	Apr. 30	May 10
Minn.				Apr. 13	Apr. 23	May 5	Apr. 19	Apr. 29	May 9
Miss.	Oct. 3	Oct. 26	Oct. 31				Feb. 1	Feb. 19	Mar. 9
Mo.							Mar. 10	Mar. 25	Apr. 10
Nebr.				Mar. 22	Apr. 2	Apr. 13	Apr. 2	Apr. 12	Apr. 23
N. H.							May 4	May 12	May 27
N. J.							Apr. 1	Apr. 12	Apr. 24
N. Y.				Apr. 14	Apr. 28	May 12	Apr. 19	Apr. 30	May 18
N. C.	Sept. 25	Oct. 14	Nov. 4				Feb. 21	Mar. 7	Mar. 23
N. Dak.				Apr. 8	Apr. 21	May 9	Apr. 24	May 5	May 19
Ohio.							Mar. 27	Apr. 9	Apr. 22
Okla.							Feb. 17	Mar. 4	Mar. 21
Pa.				Apr. 3	Apr. 17	May 2	Apr. 6	Apr. 19	May 2
R. I.							Apr. 13	Apr. 25	May 8
S. C.	Oct. 7	Oct. 31	Dec. 13	Jan. 29	Feb. 21	Mar. 12			
S. Dak.				Apr. 1	Apr. 14	Apr. 28	Apr. 8	Apr. 18	Apr. 30
Tenn.							Feb. 22	Mar. 11	Apr. 1
Tex.	Oct. 2	Oct. 24	Nov. 12	Jan. 25	Feb. 13	Feb. 23	Jan. 27	Feb. 10	Feb. 25
Vt.				Apr. 28	May 8	May 18	Apr. 29	May 9	May 22
Va.							Mar. 15	Mar. 28	Apr. 13
W. Va.							Mar. 26	Apr. 8	Apr. 22
Wis.				Apr. 10	Apr. 20	Apr. 27	Apr. 16	Apr. 24	May 7

Mean date for specified crops, with distinction of beginning, etc.—Continued.

SOWING OR PLANTING—Continued.

State.	Spring-sown barley.			Corn.			Flax.		
	Beginning.	General.	Ending.	Beginning.	General.	Ending.	Beginning.	General.	Ending.
Ala.				Mar. 12	Apr. 5	May 18			
Ark.				Mar. 18	Apr. 6	May 6			
Conn.				May 10	May 22	June 4			
Del.				Apr. 28	May 6	May 20			
Fla.				Feb. 21	Mar. 11	Apr. 2			
Ga.				Mar. 16	Apr. 4	May 7			
Ill.				Apr. 30	May 13	June 2			
Ind.	Mar. 27	Apr. 7	Apr. 19	May 1	May 14	May 31	Apr. 8	Apr. 28	May 9
Iowa	Apr. 8	Apr. 14	Apr. 22	May 4	May 13	May 26	May 1	May 17	June 6
Kans.	Mar. 18	Mar. 30	Apr. 13	Apr. 14	Apr. 29	May 18	Apr. 5	Apr. 15	May 5
Ky.				Apr. 15	May 5	May 26			
La.				Feb. 27	Mar. 22	Apr. 24			
Me.	May 12	May 26	June 11	May 17	May 26	June 6			
Md.				Apr. 26	May 8	May 31			
Mass.	May 11	May 22	June 4	May 10	May 20	May 31			
Mich.	Apr. 25	May 4	May 15	May 15	May 22	June 2			
Minn.	May 1	May 10	May 20	May 13	May 19	May 30	May 9	May 20	June 2
Miss.				Mar. 12	Apr. 1	May 10			
Mo.	Mar. 15	Apr. 3	Apr. 15	Apr. 14	May 1	May 22	Apr. 7	Apr. 15	Apr. 25
Nebr.	Apr. 8	Apr. 17	Apr. 28	May 3	May 13	May 29			
N. H.	May 16	May 21	June 4	May 14	May 24	June 4			
N. J.				May 6	May 14	May 31			
N. Y.	Apr. 23	Apr. 30	May 16	May 12	May 21	June 3			
N. C.				Mar. 30	Apr. 19	May 24			
N. Dak.	May 4	May 14	May 29	May 14	May 21	May 31	May 15	May 28	June 12
Ohio	Mar. 28	Apr. 8	Apr. 21	May 1	May 14	May 27			
Okla.	Feb. 26	Mar. 17	Mar. 31	Mar. 24	Apr. 7	Apr. 30			
Pa.	Apr. 8	Apr. 20	May 2	May 4	May 15	May 29			
R. I.				May 10	May 19	June 11			
S. C.				Mar. 18	Apr. 5	May 15			
S. Dak.	Apr. 14	Apr. 26	May 10	May 9	May 19	June 1	May 15	May 30	June 17
Tenn.				Mar. 31	Apr. 21	May 25			
Tex.				Feb. 27	Mar. 13	Apr. 4			
Vt.	May 12	May 22	June 8	May 17	May 25	June 4			
Va.				Apr. 20	May 2	May 21			
W. Va.				Apr. 26	May 10	May 27			
Wis.	Apr. 23	Apr. 30	May 9	May 11	May 18	May 28	May 5	May 14	May 26

State.	Cotton.			Tobacco.			Buckwheat.		
	Beginning.	General.	Ending.	Beginning.	General.	Ending.	Beginning.	General.	Ending.
Ala.	Apr. 8	Apr. 20	May 11						
Ark.	Apr. 15	Apr. 28	May 13	May 12	May 24	June 4			
Conn.				May 26	June 10	June 24			
Fla.	Mar. 16	Mar. 28	Apr. 20	Mar. 25	Apr. 20	May 15			
Ga.	Apr. 5	Apr. 21	May 12	Apr. 19	May 4	May 23			
Ill.				May 23	May 28	June 14	June 26	July 3	July 10
Ind.				May 25	June 9	June 26	June 17	June 26	July 3
Iowa							June 18	June 26	July 6
Ky.				May 18	June 1	June 17			
La.	Mar. 29	Apr. 15	May 7						
Me.							June 4	June 15	June 25
Md.				May 23	June 8	June 23	June 13	June 26	July 16
Mass.				May 28	June 12	June 26	June 20	June 27	July 5
Mich.							June 16	June 24	July 3
Minn.							June 6	June 17	June 24
Miss.	Apr. 5	Apr. 21	May 11						
Mo.	Apr. 25	May 4	May 14	May 27	June 7	June 20	June 28	July 9	July 27
Nebr.							June 16	June 24	July 6
N. H.							May 27	June 6	June 18
N. J.							July 2	July 8	July 18
N. Y.				June 1	June 15	June 30	June 22	July 1	July 11
N. C.	Apr. 19	May 1	May 16	Apr. 29	May 14	May 31	June 25	July 4	July 15
Ohio				May 28	June 11	June 25	June 21	June 30	July 10
Okla.	Apr. 18	May 2	May 24						
Pa.				May 30	June 12	June 27	June 14	June 28	July 10
S. C.	Apr. 5	Apr. 22	May 12	Apr. 10	Apr. 23	May 3			
Tenn.	Apr. 21	May 2	May 16	May 10	May 22	June 5			
Tex.	Mar. 29	Apr. 13	May 9						
Vt.							June 12	June 20	June 28
Va.				May 16	June 5	June 20	May 28	June 14	July 8
W. Va.				May 23	June 5	June 22	June 14	June 27	July 9
Wis.				June 4	June 16	June 30	June 12	June 20	June 29

Mean date for specified crops, with distinction of beginning, etc.—Continued.

HARVESTING.

State.	Fall-sown oats.			Fall-sown barley.			Winter wheat.		
	Beginning.	General.	Ending.	Beginning.	General.	Ending.	Beginning.	General.	Ending.
Ala.	May 27	June 8	June 19				June 4	June 13	June 23
Ark.							June 6	June 14	June 24
Del.							June 22	June 24	June 30
Fla.	May 8	May 23	June 7						
Ga.	May 28	June 9	June 22				June 1	June 9	June 21
Ill.							June 24	June 30	July 7
Ind.				June 14	June 22	June 30	June 26	July 3	July 10
Iowa.							July 3	July 11	July 15
Kans.							June 26	July 4	July 14
Ky.				June 16	June 22	June 27	June 17	June 24	July 3
La.	May 29	June 8	June 15						
Md.							June 23	June 28	July 7
Mich.							July 15	July 23	July 31
Minn.							July 15	July 23	July 29
Miss.	June 1	June 7	June 16						
Mo.							June 20	June 27	July 6
Nebr.							July 6	July 13	July 20
N. J.							July 3	July 7	July 16
N. Y.							July 10	July 19	July 28
N. C.	June 9	June 20	June 29				June 11	June 19	June 26
Ohio.				June 22	June 28	July 4	June 29	July 6	July 13
Okla.							June 12	June 20	July 7
Pa.							July 4	July 10	July 18
S. C.	May 31	June 13	June 25				June 3	June 13	June 24
S. Dak.							July 14	July 22	July 31
Tenn.							June 10	June 20	June 30
Tex.	May 27	June 8	June 19	May 28	June 5	July 16	May 29	June 9	June 22
Vt.							July 22	Aug. 2	Aug. 18
Va.							June 20	June 26	July 3
W. Va.							June 25	July 2	July 10
Wis.							July 16	July 22	July 28

State.	Winter rye.			Spring-sown barley.			Spring-sown oats.		
	Beginning.	General.	Ending.	Beginning.	General.	Ending.	Beginning.	General.	Ending.
Ala.							June 5	June 15	June 26
Ark.							June 15	June 24	July 2
Conn.	July 11	July 16	July 27				July 16	July 27	Aug. 5
Ga.	May 29	June 9	June 20				June 16	June 28	July 7
Ill.	June 22	June 29	July 5				July 9	July 16	July 24
Ind.	June 24	July 2	July 9	July 4	July 13	July 20	July 14	July 22	July 30
Iowa.	July 1	July 6	July 12	July 9	July 15	July 21	July 17	July 24	Aug. 3
Kans.	June 23	July 1	July 9	June 29	July 7	July 15	July 2	July 10	July 18
Ky.	June 20	June 28	July 7				July 4	July 13	July 22
Me.				Aug. 16	Aug. 25	Sept. 5	Aug. 13	Aug. 23	Sept. 2
Md.	June 23	June 29	July 8				July 11	July 16	July 25
Mass.	July 12	July 18	July 27	July 27	Aug. 7	Aug. 21	July 16	July 25	Aug. 3
Mich.	July 14	July 22	July 30	July 29	Aug. 7	Aug. 15	Aug. 5	Aug. 14	Aug. 23
Minn.	July 14	July 22	July 30	July 25	Aug. 2	Aug. 11	Aug. 4	Aug. 11	Aug. 19
Miss.							June 6	June 16	June 27
Mo.	June 20	June 28	July 5	July 2	July 8	July 14	July 3	July 10	July 17
Nebr.	July 4	July 11	July 18	July 11	July 18	July 26	July 16	July 25	Aug. 2
N. H.				Aug. 4	Aug. 13	Aug. 24	Aug. 9	Aug. 18	Sept. 3
N. J.	June 28	July 4	July 13				July 16	July 26	Aug. 5
N. Y.	July 11	July 20	July 28	July 30	Aug. 8	Aug. 18	July 31	Aug. 10	Aug. 22
N. C.	June 14	June 22	July 2				June 19	June 30	July 10
N. Dak.				July 31	Aug. 9	Aug. 18	Aug. 10	Aug. 17	Aug. 28
Ohio.	July 2	July 9	July 17	July 5	July 12	July 21	July 16	July 24	Aug. 1
Okla.	June 8	June 16	July 2	June 19	June 28	July 5	June 20	June 29	July 7
Pa.	July 5	July 11	July 19	July 22	July 29	Aug. 6	July 27	Aug. 5	Aug. 15
R. I.	June 17	July 5	July 28				Aug. 1	Aug. 10	Aug. 18
S. C.	May 29	June 11	June 19						
S. Dak.	July 12	July 18	July 27	July 22	July 30	Aug. 7	July 27	Aug. 5	Aug. 15
Tenn.							June 23	July 3	July 12
Tex.	June 9	June 16	June 27				July 5	July 12	July 23
Vt.	July 20	Aug. 1	Aug. 10	Aug. 8	Aug. 18	Aug. 30	Aug. 10	Aug. 21	Sept. 3
Va.	June 22	June 28	July 5				July 8	July 14	July 23
W. Va.	June 27	July 6	July 13				July 11	July 20	July 28
Wis.	July 12	July 19	July 27	July 25	Aug. 2	Aug. 9	Aug. 2	Aug. 10	Aug. 17

Mean date for specified crops, with distinction of beginning, etc.—Continued.

HARVESTING—Continued.

State.	Spring wheat.			Corn.			Flax.		
	Beginning.	General.	Ending.	Beginning.	General.	Ending.	Beginning.	General.	Ending.
Ala.				Sept. 16	Oct. 26	Dec. 1			
Ark.				Sept. 23	Oct. 14	Nov. 4			
Conn.				Sept. 10	Sept. 16	Sept. 28			
Del.				Aug. 28	Sept. 12	Sept. 28			
Fla.				Aug. 23	Sept. 23	Oct. 17			
Ga.				Sept. 16	Oct. 20	Nov. 23			
Ill.	July 17	July 22	July 28	Sept. 26	Oct. 29	Dec. 10			
Ind.				Sept. 21	Oct. 29	Dec. 8	July 12	July 18	July 24
Iowa.	July 20	July 28	Aug. 3	Oct. 19	Nov. 6	Dec. 6	Aug. 11	Aug. 22	Sept. 3
Kans.	July 11	July 20	July 30	Oct. 11	Nov. 9	Dec. 16	July 13	July 22	July 30
Ky.				Sept. 18	Oct. 21	Nov. 13			
La.				Sept. 1	Oct. 7	Nov. 4			
Me.				Sept. 12	Sept. 20	Sept. 30			
Md.				Sept. 4	Sept. 15	Sept. 25			
Mass.				Sept. 16	Sept. 24	Oct. 10			
Mich.	Aug. 8	Aug. 18	Aug. 26	Sept. 10	Sept. 20	Sept. 29			
Minn.	Aug. 6	Aug. 12	Aug. 22	Sept. 9	Sept. 17	Sept. 28	Aug. 23	Aug. 31	Sept. 11
Miss.				Sept. 21	Oct. 16	Nov. 16			
Mo.				Sept. 23	Nov. 4	Dec. 16	July 11	July 20	July 29
Nebr.	July 20	July 28	Aug. 3	Sept. 23	Oct. 24	Dec. 19			
N. H.				Sept. 8	Sept. 14	Sept. 24			
N. J.				Sept. 24	Oct. 9	Nov. 1			
N. Y.	July 30	Aug. 8	Aug. 20	Sept. 7	Sept. 18	Sept. 29			
N. C.				Sept. 25	Nov. 7	Nov. 25			
N. Dak.	Aug. 9	Aug. 19	Aug. 29	Sept. 8	Sept. 15	Sept. 23	Aug. 29	Sept. 8	Sept. 22
Ohio.				Sept. 12	Sept. 26	Oct. 9			
Okla.				Sept. 14	Oct. 24	Dec. 9			
Pa.	July 15	July 29	Aug. 13	Sept. 11	Sept. 22	Oct. 1			
R. I.				Sept. 13	Sept. 20	Oct. 8			
S. C.	June 6	June 16	June 28	Sept. 18	Oct. 21	Dec. 19			
S. Dak.	July 30	Aug. 9	Aug. 18	Oct. 12	Nov. 2	Nov. 29	Aug. 27	Sept. 8	Sept. 20
Tenn.				Sept. 26	Nov. 1	Dec. 1			
Tex.	June 12	June 22	July 6	Sept. 6	Oct. 6	Nov. 18			
Vt.	Aug. 8	Aug. 18	Aug. 30	Sept. 7	Sept. 16	Sept. 26			
Va.				Sept. 16	Nov. 1	Dec. 28			
W. Va.				Sept. 9	Sept. 19	Oct. 3			
Wis.	July 31	Aug. 8	Aug. 15	Sept. 9	Sept. 18	Sept. 28	Aug. 15	Aug. 21	Aug. 27

State.	Cotton.			Tobacco.			Buckwheat.		
	Beginning.	General.	Ending.	Beginning.	General.	Ending.	Beginning.-	General.	Ending.
Ala.	Aug. 29	Oct. 5	Dec. 7						
Ark.	Sept. 6	Oct. 10	Dec. 9	Aug. 16	Aug. 31	Sept. 21			
Conn.				July 25	Aug. 29	Sept. 12	Sept. 11	Sept. 17	Sept. 25
Fla.	Aug. 16	Sept. 26	Nov. 27	June 15	July 5	Aug. 1			
Ga.	Aug. 27	Oct. 4	Dec. 9						
Ill.				Aug. 24	Sept. 12	Sept. 24	Sept. 16	Sept. 26	Oct. 4
Ind.				Aug. 28	Sept. 16	Sept. 28	Sept. 11	Sept. 21	Sept. 27
Iowa.							Sept. 14	Sept. 22	Sept. 29
Ky.				Aug. 24	Sept. 14	Sept. 29			
La.	Aug. 26	Sept. 24	Dec. 14						
Me.							Aug. 28	Sept. 9	Sept. 20
Md.				Aug. 20	Sept. 10	Sept. 30	Sept. 7	Sept. 18	Oct. 6
Mass.				July 27	Aug. 31	Sept. 12	Aug. 22	Sept. 2	Sept. 15
Mich.							Sept. 8	Sept. 16	Sept. 26
Minn.							Aug. 27	Sept. 4	Sept. 15
Miss.	Aug. 30	Oct. 4	Dec. 10						
Mo.	Sept. 22	Oct. 24	Dec. 10	Aug. 31	Sept. 13	Sept. 26	Sept. 16	Sept. 28	Oct. 13
Nebr.							Sept. 7	Sept. 15	Sept. 24
N. H.							Aug. 28	Sept. 4	Sept. 10
N. J.							Sept. 10	Sept. 18	Sept. 28
N. Y.				Aug. 10	Aug. 25	Sept. 10	Sept. 9	Sept. 18	Sept. 28
N. C.	Sept. 5	Oct. 11	Dec. 6	Aug. 3	Aug. 24	Sept. 9	Sept. 18	Sept. 28	Oct. 6
Ohio.				Aug. 18	Sept. 6	Sept. 22	Sept. 15	Sept. 27	Oct. 7
Okla.	Sept. 16	Oct. 18	Dec. 28						
Pa.				Aug. 20	Sept. 5	Sept. 14	Sept. 6	Sept. 18	Sept. 30
S. C.	Aug. 25	Sept. 23	Dec. 5	July 12	July 22	Aug. 12			
Tenn.	Sept. 4	Oct. 4	Nov. 30	Aug. 20	Sept. 8	Sept. 25	Sept. 6	Sept. 18	Sept. 30
Tex.	Aug. 27	Oct. 2	Dec. 10						
Vt.							Sept. 10	Sept. 16	Sept. 26
Va.				Aug. 25	Sept. 9	Sept. 28	Aug. 30	Sept. 14	Sept. 28
W. Va.				Aug. 28	Sept. 12	Sept. 28	Sept. 9	Sept. 18	Sept. 28
Wis.				Aug. 17	Aug. 27	Sept. 9	Sept. 4	Sept. 12	Sept. 20

Averages by counties having been obtained, the next step is a grouping of counties, the most natural method of which is according to their latitude and longitude. Accordingly, one square degree of latitude and longitude is taken as the unit of comparison, and counties within such unit are combined and a mean date for this unit is obtained. As a succeeding step, the State is divided into equal latitudinal sections, based upon the number of degrees of latitude passing through the State, and a mean date obtained for each section. As a final step, the mean of the means of the total number of latitudinal sections into which a State is divided is taken as the State mean.

In this way individual returns are given an equal weight in determining a county average; county averages are equal factors in determining the mean of the next higher group, or sectional mean; and sectional means have an equal part to play in establishing the State mean, which represents conditions as they exist in the central portion of a State, rather than in either the northern or the southern sections.

The States of Montana, Washington, Oregon, Idaho, Colorado, Utah, Nevada, Wyoming, New Mexico, Arizona, and California present many difficulties in an investigation of this character because of abrupt changes in altitude, rainfall, etc., and are therefore omitted until complete data are obtained.

The information collected as a result of this investigation will be published in a series of bulletins. From the first of these bulletins sufficient facts have been segregated to make possible the publication of an outline map (fig. 31) and the calendars on pages 490 to 493.

AGRICULTURAL COLLEGES IN THE UNITED STATES.[1]

College instruction in agriculture is given in the colleges and universities receiving the benefits of the acts of Congress of July 2, 1862, August 30, 1890, and March 4, 1907, which are now in operation in all the States and Territories, except Alaska. The total number of these institutions is 67, of which 65 maintain courses of instruction in agriculture. In 23 States the agricultural colleges are departments of the State universities. In 15 States and Territories separate institutions having courses in agriculture are maintained for the colored race. All of the agricultural colleges for white persons and several of those for negroes offer four-year courses in agriculture and its related sciences leading to bachelors' degrees, and many provide for graduate study. About 60 of these institutions also provide special, short, and correspondence courses in the different branches of agriculture, including agronomy, horticulture, animal husbandry, poultry raising, cheese making, dairying, sugar making, rural engineering, farm mechanics, and other technical subjects. The officers of the agricultural colleges engage quite largely in conducting farmers' institutes and various other forms of college extension. The agricultural experiment stations with very few exceptions are departments of the agricultural colleges. The total number of persons engaged in the work of education and research in the land-grant colleges and the experiment stations in 1910 was 6,985; the number of students (white) in interior courses in the colleges of agriculture and mechanic arts, 45,140; the total number of students in the whole institutions, including students in correspondence courses and extension schools of five days or longer, 128,140; the number of students (white) in the four-year college courses in agriculture, 3,614; in short and special courses, 12,189; the total number of students in the institutions for negroes, 7,110, of whom 1,572 were enrolled in agricultural courses. With a few exceptions, each of these colleges offers free tuition to residents of the State in which it is located. In the excepted cases scholarships are open to promising and energetic students; and, in all, opportunities are found for some to earn part of their expenses by their own labor. The expenses are from $125 to $300 for the school year.

[1] Including only institutions established under the land-grant act of July 2, 1862.

Agricultural colleges in the United States.

State or Territory.	Name of institution.	Location.	President.
Alabama	Alabama Polytechnic Institute	Auburn	C. C. Thach.
	Agricultural School of the Tuskegee Normal and Industrial Institute.	Tuskegee Institute	B. T. Washington.
	Agricultural and Mechanical College for Negroes.	Normal	W. S. Buchanan.
Arizona	University of Arizona	Tucson	A. E. Douglass.[1]
Arkansas	College of Agriculture of the University of Arkansas.	Fayetteville	C. F. Adams.[2]
	Branch Normal College[3]	Pine Bluff	Isaac Fisher.
California	College of Agriculture of the University of California.	Berkeley	E. J. Wickson.[2]
Colorado	The State Agricultural College of Colorado.	Fort Collins	C. A. Lory.
Connecticut	Connecticut Agricultural College	Storrs	C. L. Beach.
Delaware	Delaware College	Newark	G. A. Harter.
	State College for Colored Students.	Dover	W. C. Jason.
Florida	College of Agriculture of the University of Florida.	Gainesville	J. J. Vernon.[2]
	Florida Agricultural and Mechanical College for Negroes.	Tallahassee	N. B. Young.
Georgia	Georgia State College of Agriculture.	Athens	A. M. Soule.
	Georgia State Industrial College	Savannah	R. R. Wright.
Hawaii	College of Hawaii	Honolulu	J. W. Gilmore.
Idaho	College of Agriculture of the University of Idaho.	Moscow	W. L. Carlyle.[2]
Illinois	College of Agriculture of the University of Illinois.	Urbana	E. Davenport.[2]
Indiana	School of Agriculture of Purdue University.	Lafayette	J. H. Skinner.[2]
Iowa	Iowa State College of Agriculture and Mechanic Arts.	Ames	E. W. Stanton.[1]
Kansas	Kansas State Agricultural College.	Manhattan	H. J. Waters.
Kentucky	The College of Agriculture of the State University.	Lexington	M. A. Scovell.[2]
	The Kentucky Normal and Industrial Institute for Colored Persons.	Frankfort	J. S. Hathaway.
Louisiana	Louisiana State University and Agricultural and Mechanical College.	Baton Rouge	T. D. Boyd.
	Southern University and Agricultural and Mechanical College.	New Orleans	H. A. Hill.
Maine	College of Agriculture of the University of Maine.	Orono	R. J. Aley.
Maryland	Maryland Agricultural College	College Park	R. W. Silvester.
	Princess Anne Academy for Colored Persons, Eastern Branch of the Maryland Agricultural College.	Princess Anne	T. H. Kiah.
Massachusetts	Massachusetts Agricultural College.	Amherst	K. L. Butterfield.
	Massachusetts Institute of Technology.[3]	Boston	R. C. Maclaurin.
Michigan	Michigan Agricultural College	East Lansing	J. L. Snyder.
Minnesota	College of Agriculture of the University of Minnesota.	University Farm, St. Paul.	A. F. Woods.[2]
Mississippi	Mississippi Agricultural and Mechanical College.	Agricultural College	J. C. Hardy.
	Alcorn Agricultural and Mechanical College.	Alcorn	L. J. Rowan.
Missouri	College of Agriculture of the University of Missouri.	Columbia	F. B. Mumford.[2]
	School of Mines and Metallurgy of the University of Missouri.[3]	Rolla	L. E. Young.[4]
	Lincoln Institute	Jefferson City	B. F. Allen.
Montana	Montana Agricultural College	Bozeman	Jas. M. Hamilton.
Nebraska	College of Agriculture of the University of Nebraska.	Lincoln	E. A. Burnett.[2]
Nevada	College of Agriculture of the University of Nevada.	Reno	J. E. Stubbs.
New Hampshire	New Hampshire College of Agriculture and the Mechanic Arts.	Durham	W. D. Gibbs.
New Jersey	Rutgers Scientific School (The New Jersey State College for the Benefit of Agriculture and the Mechanic Arts).	New Brunswick	W. H. S. Demarest.

[1] Acting president.
[2] Dean.
[3] Does not maintain courses in agriculture.
[4] Director.

Agricultural colleges in the United States—Continued.

State or Territory.	Name of institution.	Location.	President.
New Mexico	New Mexico College of Agriculture and Mechanic Arts.	Agricultural College	W. E. Garrison.
New York	New York State College of Agriculture at Cornell University.	Ithaca	L. H. Bailey.[1]
North Carolina	The North Carolina College of Agriculture and Mechanic Arts.	West Raleigh	D. H. Hill.
	The Agricultural and Mechanical College for the Colored Race.	Greensboro	J. B. Dudley.
North Dakota	North Dakota Agricultural College.	Agricultural College	J. H. Worst.
Ohio	College of Agriculture of the Ohio State University.	Columbus	H. C. Price.[2]
Oklahoma	Oklahoma Agricultural and Mechanical College.	Stillwater	J. H. Connell.
	Agricultural and Normal University.	Langston	I. E. Page.
Oregon	Oregon State Agricultural College	Corvallis	W. J. Kerr.
Pennsylvania	The Pennsylvania State College	State College	E. E. Sparks.
Porto Rico	University of Porto Rico	San Juan	E. G. Dexter.
Rhode Island	Rhode Island State College	Kingston	Howard Edwards.
South Carolina	The Clemson Agricultural College of South Carolina.	Clemson College	W. M. Riggs.[3]
	The Colored Normal, Industrial, Agricultural, and Mechanical College of South Carolina.	Orangeburg	T. E. Miller.
South Dakota	South Dakota State College of Agriculture and Mechanic Arts.	Brookings	Robert L. Slagle.
Tennessee	College of Agriculture of the University of Tennessee.	Knoxville	Brown Ayres.
Texas	Agricultural and Mechanical College of Texas.	College Station	R. T. Milner.
	Prairie View State Normal and Industrial College.	Prairie View	E. L. Blackshear.
Utah	The Agricultural College of Utah	Logan	J. A. Widtsoe.
Vermont	University of Vermont and State Agricultural College.	Burlington	Elias Lyman.[3]
Virginia	The Virginia Agricultural and Mechanical College and Polytechnic Institute.	Blacksburg	P. B. Barringer.
	The Hampton Normal and Agricultural Institute.	Hampton	H. B. Frissell.
Washington	State College of Washington	Pullman	E. A. Bryan.
West Virginia	College of Agriculture of West Virginia University.	Morgantown	E. D. Sanderson.[2]
	The West Virginia Colored Institute.	Institute	Byrd Prillerman.
Wisconsin	College of Agriculture of the University of Wisconsin.	Madison	H. L. Russell.[2]
Wyoming	College of Agriculture and Mechanic Arts of the University of Wyoming.	Laramie	C. O. Merica.

[1] Director. [2] Dean. [3] Acting president.

AGRICULTURAL EXPERIMENT STATIONS OF THE UNITED STATES, THEIR LOCATIONS AND DIRECTORS.

Alabama (College), Auburn: J. F. Duggar.
Alabama (Canebrake), Uniontown: F. D. Stevens.
Alabama (Tuskegee), Tuskegee Institute: G. W. Carver.
Alaska, Sitka (Rampart, Kodiak, and Fairbanks): C. C. Georgeson.[a]
Arizona, Tucson: R. H. Forbes.
Arkansas, Fayetteville: C. F. Adams.
California, Berkeley: E. J. Wickson.
Colorado, Fort Collins: C. P. Gillette.
Connecticut (State), New Haven: E. H. Jenkins.
Connecticut (Storrs), Storrs: L. A. Clinton.
Delaware, Newark: Harry Hayward.
Florida, Gainesville: P. H. Rolfs.
Georgia, Experiment: M. V. Calvin.
Guam:[b] J. B. Thompson.[a]
Hawaii (Federal), Honolulu: E. V. Wilcox.[a]
Hawaii (Sugar Planters'), Honolulu: C. F. Eckart.
Idaho, Moscow: W. L. Carlyle.
Illinois, Urbana: E. Davenport.
Indiana, Lafayette: Arthur Goss.
Iowa, Ames: C. F. Curtiss.
Kansas, Manhattan: E. H. Webster.
Kentucky, Lexington: M. A. Scovell.
Louisiana (Sugar), New Orleans: W. R. Dodson.
Louisiana (State), Baton Rouge: W. R. Dodson.
Louisiana (North), Calhoun: W. R. Dodson.
Louisiana (Rice), Crowley: W. R. Dodson.
Maine, Orono: C. D. Woods.
Maryland, College Park: H. J. Patterson.
Massachusetts, Amherst: W. P. Brooks.
Michigan, East Lansing: R. S. Shaw.
Minnesota, University Farm, St. Paul: A. F. Woods.
Mississippi, Agricultural College: J. W. Fox.
Missouri (College), Columbia: F. B. Mumford.
Missouri (Fruit), Mountain Grove: Paul Evans.
Montana, Bozeman: F. B. Linfield.
Nebraska, Lincoln: E. A. Burnett.
Nevada, Reno: J. E. Stubbs.
New Hampshire, Durham: J. C. Kendall.
New Jersey (State), New Brunswick: J. G. Lipman.[c]
New Jersey (College), New Brunswick: J. G. Lipman.[c]
New Mexico, Agricultural College: Luther Foster.
New York (State), Geneva: W. H. Jordan.
New York (Cornell), Ithaca: L. H. Bailey.
North Carolina (College), West Raleigh: C. B. Williams.
North Carolina (State), Raleigh: B. W. Kilgore.
North Dakota, Agricultural College: J. H. Worst.
Ohio, Wooster: C. E. Thorne.
Oklahoma, Stillwater: J. A. Wilson.
Oregon, Corvallis: J. Withycombe.
Pennsylvania, State College: T. F. Hunt.
Pennsylvania (Institute of Animal Nutrition), State College: H. P. Armsby.
Porto Rico (Federal), Mayaguez: D. W. May.[a]
Porto Rico (Sugar), Rio Piedras: J. T. Crawley.
Rhode Island, Kingston: H. J. Wheeler.
South Carolina, Clemson College: J. N. Harper.
South Dakota, Brookings: J. W. Wilson.
Tennessee, Knoxville: H. A. Morgan.
Texas, College Station: H. H. Harrington.
Utah, Logan: E. D. Ball.
Vermont, Burlington: J. L. Hills.
Virginia (College), Blacksburg: S. W. Fletcher.
Virginia (Truck), Norfolk: T. C. Johnson.
Washington, Pullman: R. W. Thatcher.
West Virginia, Morgantown: J. H. Stewart.
Wisconsin, Madison: H. L. Russell.
Wyoming, Laramie, H. G. Knight.

[a] Special agent in charge.
[b] Address: Island of Guam, via San Francisco.
[c] Acting director.

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OFFICIALS IN CHARGE OF AGRICULTURE.

Alabama: Commissioner of Agriculture, Montgomery.

Alaska: Special Agent in charge of Experiment Stations, Sitka.

Arizona: Director of Experiment Station, Tucson.

Arkansas: Commissioner of Agriculture, Little Rock.

California: Secretary of State Board of Agriculture, Sacramento.

Colorado: Secretary of State Board of Agriculture, Fort Collins.

Connecticut: Commissioner of Agriculture, Hartford.

Delaware: Secretary of State Board of Agriculture, Dover.

Florida: Commissioner of Agriculture, Tallahassee.

Georgia: Commissioner of Agriculture, Atlanta.

Hawaii: Secretary of Territorial Board of Agriculture, Honolulu.

Idaho: Commissioner of Immigration, Labor, and Statistics, Boise.

Illinois: Secretary of State Board of Agriculture, Springfield.

Indiana: Secretary of State Board of Agriculture, Indianapolis.

Iowa: Secretary of State Board of Agriculture, Des Moines.

Kansas: Secretary of State Board of Agriculture, Topeka.

Kentucky: Commissioner of Agriculture, Frankfort.

Louisiana: Commissioner of Agriculture, Baton Rouge.

Maine: Commissioner of Agriculture, Augusta.

Maryland: Director of Experiment Station, College Park.

Massachusetts: Secretary of State Board of Agriculture, Boston.

Michigan: Secretary of State Board of Agriculture, East Lansing.

Minnesota: Secretary of State Agricultural Society, St. Paul.

Mississippi: Commissioner of Agriculture, Jackson.

Missouri: Secretary of State Board of Agriculture, Columbia.

Montana: Commissioner of Agriculture, Helena.

Nebraska: Secretary of State Board of Agriculture, Lincoln.

Nevada: Secretary of State Board of Agriculture, Carson City.

New Hampshire: Secretary of State Board of Agriculture, Concord.

New Jersey: Secretary of State Board of Agriculture, Trenton.

New Mexico: Director of Experiment Station, Agricultural College.

New York: Commissioner of Agriculture, Albany.

North Carolina: Commissioner of Agriculture, Raleigh.

North Dakota: Commissioner of Agriculture, Bismarck.

Ohio: Secretary of State Board of Agriculture, Columbus.

Oklahoma: President of State Board of Agriculture, Oklahoma.

Oregon: Secretary of State Board of Agriculture, Salem.

Pennsylvania: Secretary of Agriculture, Harrisburg.

Philippine Islands: Director of Agriculture, Manila.

Porto Rico: Director of Experiment Station, Mayaguez.

Rhode Island: Secretary of State Board of Agriculture, Providence.

South Carolina: Commissioner of Agriculture, Columbia.

South Dakota: Secretary of State Board of Agriculture, Huron.

Tennessee: Commissioner of Agriculture, Nashville.

Texas: Commissioner of Agriculture, Austin.

Utah: Director of Experiment Station, Logan.

Vermont: Commissioner of Agriculture, Plainfield.

Virginia: Commissioner of Agriculture, Richmond.

Washington: Director of Experiment Station, Pullman.

West Virginia: Secretary of State Board of Agriculture, Charleston.

Wisconsin: Secretary of State Board of Agriculture, Madison.

Wyoming: Secretary of State Board of Agriculture, Laramie.

STATISTICS OF THE PRINCIPAL CROPS.

[Figures furnished by the Bureau of Statistics, Department of Agriculture, except where otherwise stated.
[All prices are gold.]

CORN.

Corn area of countries named, 1905-1909.

Country.	1905.	1906.	1907.	1908.	1909.
NORTH AMERICA.	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*
United States	94,011,400	96,738,000	99,931,000	101,788,000	108,771,000
Canada:					
Ontario	295,000	289,500	338,600	332,200	320,000
Quebec	(a)	(a)	35,800	33,600	32,200
Mexico	(a)	(a)	(a)	(a)	(a)
SOUTH AMERICA.					
Argentina	5,651,400	6,714,600	7,045,700	6,719,300	7,348,500
Chile	80,800	52,200	(a)	62,600	62,000
Uruguay	437,100	411,100	524,200	(a)	502,300
EUROPE.					
Austria-Hungary:					
Austria	861,100	847,500	860,800	845,100	831,200
Hungary proper	5,247,000	5,714,300	6,031,600	5,831,100	6,209,600
Croatia-Slavonia	988,400	1,004,800	988,100	1,033,300	1,003,200
Bosnia-Herzegovina	(a)	711,300	777,900	702,900	529,900
Total Austria-Hungary	....	8,277,900	8,658,400	8,412,400	8,573,900
Bulgaria	1,168,400	1,254,400	1,231,300	1,410,400	1,501,000
France	1,241,400	1,154,900	1,236,500	1,226,200	1,222,600
Italy	4,843,800	4,491,000	4,483,500	4,444,700	4,005,000
Portugal	(a)	(a)	(a)	(a)	(a)
Roumania	4,882,200	5,144,500	4,765,600	4,992,300	5,247,100
Russia:					
Russia proper	2,870,400	2,573,300	2,899,300	2,970,900	3,050,800
Poland	(a)	(a)	(a)	(a)	(a)
Northern Caucasia	630,900	630,000	571,300	659,400	733,600
Total Russia (European)	b 3,501,300	b 3,203,300	b 3,470,600	b 3,630,300	b 3,784,400
Servia	(a)	(a)	1,358,400	1,392,600	1,383,800
Spain	1,148,900	1,103,000	1,109,500	1,133,300	1,149,100
AFRICA.					
Algeria	32,700	37,500	39,000	37,600	53,500
Egypt	1,809,200	1,837,400	1,867,700	1,868,100	1,865,000
Sudan (Anglo-Egyptian)	(a)	(a)	(a)	(a)	(a)
Union of South Africa	(a)	(a)	(a)	(a)	(a)
AUSTRALASIA.					
Australia:					
Queensland	119,200	113,700	139,800	127,100	127,700
New South Wales	193,600	189,400	174,100	161,000	180,800
Victoria	11,400	11,800	11,600	10,900	14,000
Western Australia	100	100	100	200	200
New Zealand	10,100	10,500	8,900	8,900	11,500
Total Australasia	334,400	325,500	334,500	308,100	334,200

a No official statistics of area; estimates of production on page 500. b Exclusive of Poland.

CORN—Continued.

Corn crop of countries named, 1905–1909.

Country.	1905.	1906.	1907.	1908.	1909.
NORTH AMERICA.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
United States	2,707,994,000	2,927,416,000	2,592,320,000	2,668,651,000	2,772,376,000
Canada:					
Ontario	20,923,000	23,989,000	21,899,000	21,742,000	18,211,000
Quebec			1,377,000	1,126,000	1,047,000
Mexico	86,544,000	110,065,000	100,000,000	100,000,000	100,000,000
Total	2,815,461,000	3,061,470,000	2,715,596,000	2,791,519,000	2,891,634,000
SOUTH AMERICA.					
Argentina	140,708,000	194,912,000	71,768,000	136,055,000	177,155,000
Chile	1,244,000	846,000	1,500,000	1,218,000	1,178,000
Uruguay	4,417,000	3,226,000	5,359,000	6,000,000	6,671,000
Total	146,369,000	198,984,000	78,627,000	143,273,000	185,004,000
EUROPE.					
Austria-Hungary:					
Austria	17,293,000	18,177,000	16,599,000	15,170,000	16,102,000
Hungary proper	94,045,000	162,925,000	155,619,000	146,124,000	161,858,000
Croatia-Slavonia	18,385,000	20,470,000	17,934,000	20,536,000	21,752,000
Bosnia-Herzegovina	9,584,000	8,900,000	6,468,000	8,821,000	10,972,000
Total Austria-Hungary	139,307,000	210,472,000	196,620,000	190,651,000	210,684,000
Bulgaria	18,141,000	27,780,000	14,080,000	20,717,000	20,472,000
France	24,030,000	14,581,000	24,027,000	25,974,000	26,075,000
Italy	97,266,000	93,007,000	88,513,000	95,953,000	99,289,000
Portugal	15,000,000	15,000,000	15,000,000	15,000,000	15,000,000
Roumania	59,275,000	130,546,000	57,576,000	78,892,000	70,138,000
Russia:					
Russia proper	22,533,000	59,320,000	41,903,000	49,663,000	29,223,000
Poland			1,000		
Northern Caucasia	10,798,000	11,181,000	8,860,000	11,449,000	10,375,000
Total Russia (European)	33,331,000	70,501,000	50,764,000	61,112,000	39,598,000
Servia	21,431,000	27,786,000	17,691,000	21,010,000	27,558,000
Spain	31,880,000	18,714,000	25,372,000	20,115,000	26,433,000
Total	439,661,000	608,387,000	489,643,000	529,424,000	535,247,000
AFRICA.					
Algeria	490,000	544,000	402,000	426,000	807,000
Egypt	30,000,000	30,000,000	35,000,000	30,000,000	30,000,000
Sudan (Anglo-Egyptian)	320,000	300,000	300,000	300,000	300,000
Union of South Africa	20,000,000	20,000,000	20,000,000	20,000,000	20,000,000
Total	50,810,000	50,844,000	55,702,000	50,726,000	51,107,000
AUSTRALASIA.					
Australia:					
Queensland	2,623,000	2,233,000	3,820,000	3,191,000	2,855,000
New South Wales	5,107,000	5,714,000	5,945,000	4,671,000	5,380,000
Victoria	643,000	661,000	727,000	525,000	671,000
Western Australia	1,000	1,000	1,000	1,000	2,000
Total	8,374,000	8,609,000	10,493,000	8,388,000	8,908,000
New Zealand	506,000	653,000	419,000	519,000	736,000
Total Australasia	8,880,000	9,262,000	10,912,000	8,907,000	9,644,000
Grand total	3,461,181,000	3,928,947,000	3,350,480,000	3,523,849,000	3,672,636,000

CORN—Continued.

Acreage, production, value, prices, and exports of corn in the United States, 1849–1910.

Year.	Acreage.	Average yield per acre.	Production.	Average farm price per bushel Dec. 1.	Farm value Dec. 1.	Chicago cash price per bushel, No. 2. December. Low.	December. High.	May of following year. Low.	May of following year. High.	Domestic exports, including corn meal, fiscal year beginning July 1.	Per cent of crop exported.
	Acres.	*Bush.*	*Bushels.*	*Cents.*	*Dollars.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Bushels.*	*P. ct.*
1849 [a]	....	......	592,071,000	....	....	....	.....	....	.....	7,632,860	1.3
1859 [a]	....	......	838,793,000	....	....	....	.....	....	.....	4,248,991	.5
1866..	34,307,000	25.3	867,946,000	47.4	411,451,000	53	62	64	79	16,026,947	1.8
1867..	32,520,000	23.6	768,320,000	57.0	437,770,000	61	65	61	71	12,493,522	1.6
1868..	34,887,000	26.0	906,527,000	46.8	424,057,000	38	58	44	51	8,286,665	.9
1869..	37,103,000	23.6	874,320,000	59.8	522,551,000	56	67	73	85	2,140,487	.2
1870..	38,647,000	28.3	1,094,255,000	49.4	540,520,000	41	59	46	52	10,673,553	1.0
1871..	34,091,000	29.1	991,898,000	43.4	430,356,000	36	39	38	43	35,727,010	3.6
1872..	35,527,000	30.8	1,092,719,000	35.3	385,736,000	27	28	34	39	40,154,374	3.7
1873..	39,197,000	23.8	932,274,000	44.2	411,961,000	40	49	49	59	35,985,834	3.9
1874..	41,037,000	20.7	850,148,000	58.4	496,271,000	64	76	53	67	30,025,036	3.5
1875..	44,841,000	29.5	1,321,069,000	36.7	484,675,000	40	47	41	45	50,910,532	3.9
1876..	49,033,000	26.2	1,283,828,000	34.0	436,109,000	40	43	43	56	72,652,611	5.7
1877..	50,369,000	26.7	1,342,558,000	34.8	467,635,000	41	49	35	41	87,192,110	6.5
1878..	51,585,000	26.9	1,388,219,000	31.7	440,281,000	30	32	33	36	87,884,892	6.3
1879..	53,085,000	29.2	1,547,902,000	37.5	580,486,000	39	43¼	32⅜	36⅛	99,572,329	6.4
1880..	62,318,000	27.6	1,717,435,000	39.6	679,714,000	35⅝	42	41½	45	93,648,147	5.5
1881..	64,262,000	18.6	1,194,916,000	63.6	759,482,000	58½	63½	69	76⅞	44,340,683	3.7
1882..	65,660,000	24.6	1,617,025,000	48.5	783,867,000	49¼	61	53¼	56¾	41,655,653	2.6
1883..	68,302,000	22.7	1,551,067,000	42.4	658,051,000	54¼	63⅛	52½	57	46,258,606	3.0
1884..	69,684,000	25.8	1,795,528,000	35.7	640,736,000	34½	40¼	44¾	49	52,876,456	2.9
1885..	73,130,000	26.5	1,936,176,000	32.8	635,675,000	36	42¾	34¼	36¾	64,829,617	3.3
1886..	75,694,000	22.0	1,665,441,000	36.6	610,311,000	35¾	38	36⅞	39⅜	41,368,584	2.5
1887..	72,393,000	20.1	1,456,161,000	44.4	646,107,000	47	51⅛	54	60	25,360,869	1.7
1888..	75,673,000	26.3	1,987,790,000	34.1	677,562,000	33½	35⅞	33⅛	35⅜	70,841,673	3.6
1889..	78,320,000	27.0	2,112,892,000	28.3	597,919,000	29¼	35	32¾	35	103,418,709	4.9
1890..	71,971,000	20.7	1,489,970,000	50.6	754,433,000	47¾	53	55	69½	32,041,529	2.2
1891..	76,205,000	27.0	2,060,154,000	40.6	836,439,000	39⅜	59	40¾	[b]100	76,602,285	3.7
1892..	70,627,000	23.1	1,628,464,000	39.4	642,147,000	40	42⅞	39½	44½	47,121,894	2.9
1893..	72,036,000	22.5	1,619,496,000	36.5	591,626,000	34¼	36½	36¾	38½	66,489,529	4.1
1894..	62,582,000	19.4	1,212,770,000	45.7	554,719,000	44¾	47½	47¾	55½	28,585,405	2.4
1895..	82,076,000	26.2	2,151,139,000	25.3	544,986,000	25	26¾	27½	29½	101,100,375	4.7
1896..	81,027,000	28.2	2,283,875,000	21.5	491,007,000	22½	23¾	23	25½	178,817,417	7.8
1897..	80,095,000	23.8	1,902,968,000	26.3	501,073,000	25	27½	32⅜	37	212,055,543	11.1
1898..	77,722,000	24.8	1,924,185,000	28.7	552,023,000	33⅛	38	32½	34⅜	177,255,046	9.2
1899..	82,109,000	25.3	2,078,144,000	30.3	629,210,000	30	31½	36	40½	213,123,412	10.3
1900..	83,321,000	25.3	2,105,103,000	35.7	751,220,000	35¼	40½	42⅝	58½	181,405,473	8.6
1901..	91,350,000	16.7	1,522,520,000	60.5	921,556,000	62½	67½	59⅛	64¾	28,028,688	1.8
1902..	94,044,000	26.8	2,523,648,000	40.3	1,017,017,000	43¾	57¼	44	46	76,639,261	3.0
1903..	88,092,000	25.5	2,244,177,000	42.5	952,869,000	41	43¾	47¼	50	58,222,061	2.6
1904..	92,232,000	26.8	2,467,481,000	44.1	1,087,461,000	43½	49	48	64½	90,293,483	3.7
1905..	94,011,000	28.8	2,707,994,000	41.2	1,116,697,000	42	50¼	47½	50	119,893,833	4.4
1906..	96,738,000	30.3	2,927,416,000	39.9	1,166,626,000	40	46	49½	56	86,368,228	3.0
1907..	99,931,000	25.9	2,592,320,000	51.6	1,336,901,000	57½	61½	67¾	82	55,063,860	2.1
1908..	101,788,000	26.2	2,668,651,000	60.6	1,616,145,000	56¾	62¼	72¼	76	37,665,040	1.4
1909..	108,771,000	25.5	2,772,376,000	59.6	1,652,822,000	62½	66	56	63	38,128,498	1.4
1910..	114,002,000	27.4	3,125,713,000	48.8	1,523,968,000	45½	50	.....	......	....	.....

[a] Census figures of production.

[b] Coincident with "corner."

CORN—Continued.

Acreage, production, value, and distribution of corn in the United States in 1910, by States.

[Quantity expressed in bushels, 000 omitted.]

State, Territory, or Division.	Crop of 1910. Acreage.	Crop of 1910. Production.	Crop of 1910. Farm value Dec. 1.	Farm reserves of preceding year's growth Nov. 1— 1910.		Farm reserves of preceding year's growth Nov. 1— 10-year average.	Farm reserves Mar. 1— 1911.		Farm reserves Mar. 1— 10-year average.	Shipped out of county where grown. 1911.		Shipped out of county where grown. 10-year average.
	Acres.	*Bush.*	*Dollars.*	*Bu.*	*P.c.*	*P.c.*	*Bush.*	*P.c.*	*P.c.*	*Bush.*	*P.c.*	*P.c.*
Maine	17,000	782	555,000	6	1.0	1.2	235	30	21	8	1	0
New Hampshire	31,000	1,426	984,000	8	.8	1.2	485	34	26	0	0	0
Vermont	67,000	2,881	1,901,000	72	3.0	2.0	951	33	28	0	0	0
Massachusetts	50,000	2,275	1,592,000	45	2.5	1.7	796	35	28	46	2	0
Rhode Island	11,000	440	365,000	19	5.3	3.8	194	44	36	8	2	1
Connecticut	63,000	3,352	2,279,000	57	2.3	1.2	1,240	37	30	68	2	1
New York	680,000	26,044	16,408,000	386	1.6	2.0	8,334	32	30	780	3	2
New Jersey	290,000	10,440	6,264,000	522	5.5	4.0	4,176	40	41	1,976	19	13
Pennsylvania	1,586,000	65,026	38,365,000	1,659	3.4	3.6	24,710	38	37	4,550	7	6
North Atlantic	2,795,000	112,666	68,713,000	2,774	3.0	3.1	41,121	36.5	35.1	7,436	6.6	5.3
Delaware	202,000	6,424	3,340,000	174	2.8	2.4	2,570	40	46	2,304	36	38
Maryland	710,000	23,785	13,795,000	681	3.1	2.6	9,514	40	42	6,426	27	29
Virginia	2,142,000	54,621	35,504,000	1,420	3.0	3.2	22,941	42	43	5,460	10	10
West Virginia	920,000	23,920	16,266,000	884	3.2	3.8	6,698	28	34	956	4	6
N. Carolina	3,072,000	57,139	43,426,000	1,071	2.2	2.8	26,855	47	44	2,855	5	4
S. Carolina	2,418,000	44,733	36,681,000	1,148	3.1	2.8	23,261	52	45	1,788	4	3
Georgia	4,532,000	65,714	51,257,000	1,407	2.3	2.3	29,571	45	46	1,971	3	4
Florida	678,000	8,814	7,492,000	67	.8	1.3	3,526	40	40	264	3	3
South Atlantic	14,674,000	285,150	207,761,000	6,852	2.7	2.8	124,936	43.8	43.1	22,024	7.7	8.7
Ohio	3,960,000	144,540	66,488,000	7,806	5.1	4.3	56,371	39	37	31,790	22	23
Indiana	5,120,000	201,216	80,486,000	11,005	5.6	4.6	84,511	42	39	70,420	35	30
Illinois	10,609,000	414,812	157,629,000	20,707	5.6	4.0	178,369	43	41	199,104	48	41
Michigan	2,100,000	68,040	36,061,000	2,448	3.5	3.4	23,814	35	33	3,400	5	7
Wisconsin	1,575,000	51,188	26,618,000	1,416	2.8	4.1	15,356	30	31	1,024	2	5
N. C. E. Miss. R.	23,364,000	879,796	367,282,000	43,382	5.2	4.2	358,421	40.7	38.5	305,738	34.8	30.1
Minnesota	1,724,000	56,375	25,369,000	2,647	4.5	3.2	16,349	29	32	14,100	25	12
Iowa	9,473,000	343,870	123,793,000	17,388	6.0	3.2	151,303	44	40	103,170	30	20
Missouri	8,300,000	273,900	120,516,000	7,698	3.6	4.6	115,038	42	37	38,346	14	12
North Dakota	214,000	2,996	1,738,000	79	1.3	.6	210	7	20	30	1	2
South Dakota	2,162,000	54,050	21,620,000	2,937	4.5	2.6	13,512	25	36	15,148	28	23
Nebraska	8,000,000	206,400	74,304,000	15,137	7.8	4.2	90,816	44	40	72,240	35	38
Kansas	8,900,000	169,100	76,095,000	6,477	4.2	4.6	71,022	42	32	33,820	20	21
N. C. W. Miss. R.	38,773,000	1,106,691	443,435,000	52,363	5.3	3.9	458,250	41.4	37.4	276,854	25.0	22.2
Kentucky	3,630,000	105,270	55,793,000	5,174	5.0	4.4	43,161	41	40	13,689	13	10
Tennessee	3,720,000	96,348	53,955,000	2,281	2.9	3.1	42,393	44	40	15,424	16	14
Alabama	3,524,000	63,432	45,037,000	480	1.1	2.1	28,544	45	43	2,536	4	3
Mississippi	3,232,000	66,256	41,741,000	407	1.0	2.3	30,478	46	40	1,989	3	2
Louisiana	2,493,000	58,835	32,359,000	512	1.0	1.4	25,299	43	32	8,820	15	4
Texas	8,800,000	181,280	114,206,000	1,712	1.4	2.7	61,635	34	31	18,130	10	8
Oklahoma	5,772,000	92,352	47,100,000	2,023	2.0	2.8	20,317	22	32	15,708	17	22
Arkansas	2,884,000	69,216	40,145,000	857	1.7	3.2	29,763	43	37	3,460	5	4
South Central	34,055,000	732,989	430,336,000	13,446	2.3	3.0	281,590	38.4	35.8	79,756	10.9	10.8
Montana	8,000	184	175,000	3	1.5	.6	2	1	16	0	0	1
Wyoming	6,000	60	40,000	1	1.0	.4	3	5	17	1	1	0
Colorado	143,000	2,846	1,708,000	147	4.5	1.9	569	20	25	420	15	7
New Mexico	70,000	1,610	1,449,000	49	2.3	.7	225	14	22	112	7	5
Arizona	12,000	390	429,000	6	1.5	.2	55	14	17	40	10	4
Utah	13,000	394	331,000	2	.5	.2	83	21	18	20	5	3
Idaho	6,000	192	136,000	1	.6	.7	27	14	15	4	2	3
Washington	16,000	448	336,000	5	1.2	.7	67	15	15	20	4	3
Oregon	18,000	459	367,000	13	2.5	.8	64	14	12	10	2	2
California	49,000	1,838	1,470,000	12	.7	1.8	221	12	14	540	30	14
Far Western	341,000	8,421	6,441,000	239	2.5	1.4	1,316	15.6	19.8	1,167	13.7	7.5
United States	114,002,000	3,125,713	1,523,968,000	119,056	4.3	3.8	1,265,634	40.5	38.3	692,975	22.2	20.7

CORN—Continued.

Average yield per acre of corn in the United States.

State, Territory, or Division.	10-year averages. 1866–1875.	1876–1885.	1886–1895.	1896–1905.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	1909.	1910.
	Bu.	*Bu.*	*Bu.*	*Bu*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*
Maine	29.3	33.8	34.3	35.1	39.4	21.7	30.2	39.7	34.3	37.0	37.0	40.5	38.0	46.0
New Hampshire	35.5	35.5	34.5	34.0	38.5	23.3	21.0	27.3	37.0	37.5	35.0	39.0	35.1	46.0
Vermont	36.0	35.3	35.5	35.1	40.0	21.8	23.4	35.9	34.7	35.5	36.0	40.3	37.0	43.0
Massachusetts	34.6	32.5	35.7	35.9	40.5	31.3	24.0	36.0	37.5	39.7	36.0	40.4	38.0	45.5
Rhode Island	26.9	30.8	31.2	31.9	32.1	28.4	30.1	34.1	32.5	33.1	31.2	42.8	33.2	40.0
Connecticut	30.9	29.1	33.4	35.8	39.0	31.5	22.4	38.9	42.7	40.0	33.0	41.3	41.0	53.2
New York	31.6	30.4	31.1	30.3	33.0	25.0	25.0	27.3	31.5	34.9	27.0	38.8	36.0	38.3
New Jersey	36.5	32.8	20.9	34.3	36.9	34.5	24.0	38.0	35.8	36.3	31.5	38.0	32.7	36.0
Pennsylvania	35.1	32.6	30.4	34.5	35.0	36.1	31.2	34.0	38.9	40.2	32.5	39.5	32.0	41.0
North Atlantic	34.2	32.0	30.9	33.5	35.0	32.5	28.3	32.9	36.7	38.3	31.3	39.3	33.6	40.3
Delaware	20.5	22.5	19.8	26.8	30.0	28.0	27.5	30.4	30.4	30.0	27.5	32.0	31.0	31.8
Maryland	24.7	26.0	23.5	32.0	34.2	32.4	28.7	33.4	36.9	35.0	34.2	36.6	31.4	33.5
Virginia	20.0	17.9	17.4	21.0	22.2	22.0	21.8	23.3	23.4	24.3	25.0	26.0	23.2	25.5
West Virginia	29.3	25.8	22.2	26.4	23.0	26.5	22.6	25.3	29.8	30.3	28.0	31.2	31.4	26.0
North Carolina	14.3	13.3	12.4	13.4	12.0	13.9	14.7	15.2	13.9	15.3	16.5	18.0	16.8	18.6
South Carolina	9.7	8.8	10.2	9.5	6.9	10.4	10.3	12 4	10.9	12.2	15.1	14.1	16.7	18.5
Georgia	11.3	10.3	11.2	10 5	10.0	9.0	11.7	11.9	11.0	12.0	13.0	12.5	13.9	14.5
Florida	10.9	9.5	10.2	9.3	9.0	8.6	9.9	10.7	10.1	11.0	11.3	10.5	12.6	13.0
South Atlantic	17.4	14.4	13.9	15.0	14.2	14.7	15.3	16.5	16.0	16.9	17.8	18.3	18.5	19.4
Ohio	35.3	32.6	28.8	34.8	26.1	38.0	29.6	32.5	37.8	42.6	34.6	38.5	39.5	36.5
Indiana	32.3	29.9	28.9	34.0	19.8	37.9	33.2	31.5	40.7	39.6	36.0	30.3	40.0	39.3
Illinois	29.9	27.2	29.0	34.5	21.4	38.7	32.2	36.5	39.8	36.1	36.0	31.6	35.9	39.1
Michigan	32.2	31.8	26.7	32.2	34.5	26.4	33.5	28.6	34.0	37.0	30.1	31.8	35.4	32.4
Wisconsin	31.4	30.4	27.4	33.2	27.4	28.2	29.3	29.7	37.6	41.2	32.0	33.7	33.0	32.5
N. C. E. of Miss. R.	31.9	29.2	28.7	34.2	23.1	36.8	31.9	33.7	39.2	38.4	35.0	32.7	37.2	37.7
Minnesota	32.2	30.9	27.6	29.1	26.3	22.8	28.3	26.9	32.5	33.6	27.0	29.0	34.8	32.7
Iowa	34.3	31.8	30.1	32.4	25.0	32.0	28.0	32.6	34.8	39.5	29.5	31.7	31.5	36.3
Missouri	30.1	28.6	27.7	27.4	10.1	39.0	32.4	26.2	33.8	32.3	31.0	27.0	26.4	33.0
North Dakota	.....	.....	20.1	22.6	22.6	19.4	25.2	21.2	27.5	27.8	20.0	23.8	31.0	14.0
South Dakota	.....	.....	16.8	25.8	21.0	18.9	27.2	28.1	31.8	33.5	25.5	29.7	31.7	25.0
Nebraska	32.5	35.5	25.2	28.0	14.1	32.3	26.0	32.8	32.8	34.1	24.0	27.0	24.8	25.8
Kansas	33.5	33.4	22.2	22.0	7.8	29.9	25.6	20.9	27.7	28.9	22.1	22.0	19.9	19.0
N. C. W. of Miss. R.	32.4	31.4	26.1	27.7	15.6	32.0	27.9	28.7	32.4	34.1	26.8	27.4	26.7	28.5
Kentucky	29.3	26.0	24.9	25.5	15.6	27.0	26.6	26.9	29.7	33.0	28.2	25.2	29.0	29.0
Tennessee	22.9	21.4	21.5	21.9	14.2	21.9	23.5	25.0	24.6	28.1	26.0	24.8	22.0	25.9
Alabama	14.0	12.4	12.8	12.6	10.9	8.4	14.8	15.0	14.8	16.0	15.5	14.7	13.5	18.0
Mississippi	16.0	14.2	14.7	14.7	10.9	11.5	18.4	19.1	14.3	18.5	17.0	17.3	14.5	20.5
Louisiana	18.2	16.3	16.2	16.3	13.7	12.5	20.6	19.9	13.7	17.2	17.5	19.8	23.0	23.6
Texas	23.7	19.8	19.0	17.7	11.6	8.1	24.2	22.6	21.3	22.5	21.0	25.7	15.0	20.6
Oklahoma	.....	.....	.....	23.5	9.5	25.4	25.5	30.2	26.4	33.3	24.4	24.8	17.0	16.0
Arkansas	25.7	21.4	19.2	17.8	8.1	21.3	20.9	21.6	17.3	23.6	17.2	20.2	18.0	24.0
South Central	23.4	19.7	19.1	18.9	11.9	16.8	22.4	23.1	21.8	24.8	21.5	22.7	18.3	21.5
Montana	.....	26.6	26.1	22.3	25.0	22.0	24.1	22.2	19.4	23.4	22.5	23.4	35.0	23.0
Wyoming	.....	.....	23.6	24.7	39.5	19.8	19.4	32.5	26.9	27.0	25.0	28.0	28.0	10.0
Colorado	.....	25.3	22.8	18.7	17.1	16.5	19.8	20.5	23.8	27.9	23.5	20.2	24.2	19.9
New Mexico	.....	20.4	20.7	23.2	31.6	22.0	24.0	22.7	25.3	29.4	29.0	27.0	31.3	23.0
Arizona	.....	21.1	20.2	22.3	18.0	20.2	22.4	23.8	27.0	29.5	37.5	33.2	32.1	32.5
Utah	.....	23.3	19.9	23.8	19.4	20.1	21.4	33.2	36.2	32.0	25.5	29.4	31.4	30.3
Idaho	.....	22.5	24.2	27.7	23.0	24.7	34.5	29.3	27.2	28.3	30.0	29.0	30.6	32.0
Washington	.....	26.4	20.7	20.0	17.5	23.0	23.1	24.7	24.2	25.2	27.0	25.5	27.8	28.0
Oregon	29.5	26.3	24.3	23.8	20.8	23.4	25.8	28.8	23.0	27.6	27.5	27.8	30.7	25.5
California	28.6	29.2	29.6	29.9	31.0	30.5	30.7	28.6	32.0	34.9	34.0	32.0	34.8	37.5
Far Western	28.7	25.6	24.3	23.1	23.1	21.6	23.8	24.1	26.3	29.6	27.5	25.3	28.7	24.7
United States	26.1	25.5	23.4	25.2	16.7	26.8	25.5	26.8	28.8	30.3	25.9	26.2	25.5	27.4

CORN—Continued.

Average farm value per acre of corn in the United States December 1.

State, Territory, or Division.	10-year averages. 1866–1875.	1876–1885.	1886–1895.	1896–1905.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	1909.	1910.
	Dolls.	Dolls.	Dolls.	Dolls	Dolls.	Dolls.	Dolls.	Dolls.	Dolls.	Dolls.	Dolls.	Dolls.	Dolls.	Dolls
Maine	29.89	26.36	23.32	21.41	29.94	16.06	19.93	32.16	23.67	23.68	27.75	34.00	30.41	32.65
N. Hampshire	33.72	27.34	22.77	20.40	30.03	17.01	13.23	19.66	25.53	24.00	26.23	30.82	26.67	31.74
Vermont	33.84	26.12	22.72	20.01	29.20	14.82	14.51	26.21	23.60	20.95	27.00	31.44	27.02	28.37
Massachusetts	31.83	24.70	22.85	21.54	30.78	23.16	15.84	25.92	26.25	23.82	27.00	32.73	30.79	31.84
Rhode Island	26.63	24.33	21.22	21.69	24.40	22.15	24.38	28.64	23.08	21.18	25.00	38.50	32.18	33.18
Connecticut	29.66	21.53	21.38	21.84	29.25	23.31	15.01	28.40	30.32	24.00	24.75	33.03	30.75	36.17
New York	24.33	19.15	17.73	16.36	23.76	16.75	15.00	17.47	19.21	20.59	19.17	31.04	26.64	24.13
New Jersey	25.18	19.35	16.69	16.81	24.35	19.32	13.68	22.04	19.69	19.24	19.85	26.22	23.22	21.60
Pennsylvania	23.17	18.58	15.50	16.56	21.70	20.94	17.78	20.06	21.01	20.90	20.80	28.84	22.40	24.19
N. Atlantic	24.73	19.39	16.62	16.92	23.10	19.62	16.49	20.15	20.86	20.81	20.74	29.40	24.11	24.58
Delaware	11.89	11.02	8.71	10.99	17.10	13.72	13.48	14.90	14.29	12.60	14.30	18.88	17.98	16.53
Maryland	15.31	13.26	10.81	13.76	19.84	16.52	14.64	16.70	17.71	15.75	18.47	22.69	20.41	19.43
Virginia	11.40	9.13	8.18	9.87	13.10	11.44	11.55	13.75	12.40	13.37	16.00	18.46	17.17	16.58
W. Virginia	16.41	12.90	11.10	13.46	14.95	14.31	14.46	16.19	15.79	16.66	20.16	24.02	23.24	17.68
N. Carolina	9.30	7.58	6.57	7.37	8.76	8.34	8.97	9.42	8.90	10.40	12.21	14.22	14.28	14.14
S. Carolina	8.73	6.34	6.12	5.89	5.80	7.18	7.11	8.68	8.07	8.91	11.78	12.83	15.03	15.17
Georgia	9.15	7.00	6.61	6.40	8.20	6.57	8.07	8.45	7.70	8.04	9.88	10.25	11.95	11.31
Florida	12.23	7.60	6.83	6.04	7.65	6.62	7.23	8.02	6.67	6.82	9.04	8.61	10.46	11.05
S. Atlantic	11.88	8.32	7.35	8.00	9.85	8.86	9.39	10.44	9.69	10.30	12.54	14.13	14.83	14.16
Ohio	15.53	14.02	11.23	12.88	14.88	15.96	13.91	14.95	16.25	16.61	17.99	24.25	22.12	16.79
Indiana	12.27	11.36	10.40	11.22	10.89	13.64	11.95	12.91	15.47	14.26	16.20	18.18	20.00	15.72
Illinois	10.17	9.52	9.57	11.38	12.20	13.93	11.59	14.23	15.12	13.00	15.84	18.01	18.67	14.86
Michigan	17.39	14.63	11.75	13.20	17.94	13.73	15.41	14.87	15.64	16.28	16.56	20.35	21.59	17.17
Wisconsin	15.07	12.16	10.41	12.28	14.25	14.10	12.60	13.66	15.79	16.89	17.60	20.56	19.80	16.90
N. Central east of Miss. R.	12.41	11.07	10.22	11.76	12.86	14.19	12.41	14.04	15.45	14.38	16.46	19.50	19.88	15.72
Minnesota	14.81	11.43	9.38	9.02	11.83	9.12	10.75	9.68	10.72	11.42	13.50	15.95	17.05	14.72
Iowa	10.29	8.59	9.03	9.40	13.00	10.56	10.64	10.76	11.83	12.64	12.69	16.48	15.44	13.07
Missouri	12.04	9.44	9.14	9.59	6.77	12.87	11.02	11.53	12.51	12.27	14.57	15.39	15.58	14.52
N. Dakota	......	......	7.44	8.59	10.40	8.73	10.58	8.48	9.90	10.84	12.00	14.28	17.05	8.12
S. Dakota	......	......	5.38	7.74	9.45	7.75	9.52	10.12	9.86	9.72	11.73	14.85	15.85	10.00
Nebraska	11.70	8.52	7.31	7.84	7.61	9.69	7.28	10.82	10.50	9.89	9.84	13.77	12.40	9.29
Kansas	14.07	9.35	7.10	7.26	4.91	10.17	9.22	8.57	9.14	9.25	9.72	12.10	10.75	8.55
N. Central west of Miss. R.	11.66	9.07	8.09	8.56	8.53	10.54	9.63	10.39	10.91	11.08	11.89	14.65	13.94	11.44
Kentucky	12.01	10.92	9.96	10.71	9.52	11.34	14.90	13.18	12.77	13.86	14.95	16.38	17.98	15.37
Tennessee	10.76	8.99	8.82	9.64	9.23	10.29	11.52	12.50	12.30	13.21	14.82	15.87	15.40	14.50
Alabama	10.92	7.94	7.04	7.06	8.39	5.63	8.44	9.00	9.47	10.24	11.63	12.20	11.48	12.78
Mississippi	13.12	8.95	7.94	7.94	8.07	7.02	9.94	10.70	9.30	11.28	12.75	14.36	11.74	12.91
Louisiana	15.29	10.76	8.91	8.80	10.27	8.25	11.95	11.34	8.36	10.32	12.25	13.86	15.87	12.98
Texas	15.88	12.28	9.50	8.67	9.28	5.35	11.62	11.75	10.44	11.25	12.60	15.16	11.40	12.98
Oklahoma	......	......	......	9.16	7.38	10.38	9.84	11.96	10.10	10.32	10.72	12.65	9.35	8.16
Arkansas	16.96	11.34	9.02	8.54	6.56	10.44	10.66	11.45	9.51	11.09	11.70	13.33	12.96	13.92
S. Central	13.43	9.95	8.84	8.83	8.63	8.38	11.20	11.61	10.51	11.47	12.61	14.34	12.67	12.64
Montana	......	23.41	18.27	14.72	22.50	15.84	14.94	15.10	13.19	15.21	15.25	21.25	30.00	21.88
Wyoming	......	......	14.63	15.07	28.44	11.68	11.25	18.52	20.17	15.93	17.33	21.33	21.80	6.67
Colorado	......	20.75	12.31	9.16	12.65	9.73	10.69	11.07	11.19	13.95	15.27	14.34	16.94	11.94
New Mexico	......	17.34	14.28	15.54	24.33	17.16	18.00	17.71	17.46	21.17	20.88	21.60	28.16	20.70
Arizona	......	17.72	15.15	20.96	16.20	20.40	20.16	21.66	26.19	25.03	33.75	34.92	32.08	35.75
Utah	......	17.94	12.14	15.71	17.46	13.47	14.98	23.90	25.34	23.68	18.36	21.18	27.31	25.46
Idaho	......	19.80	15.73	17.45	13.80	15.31	19.67	20.51	17.95	15.85	21.00	20.33	23.00	22.67
Washington	......	20.86	12.83	11.40	10.15	14.95	12.70	16.30	14.52	13.86	18.92	19.38	23.93	21.00
Oregon	25.96	21.30	15.07	14.28	11.86	15.44	17.29	17.57	13.57	17.94	20.38	21.44	24.59	20.39
California	38.60	23.07	17.76	19.73	21.08	23.49	22.72	22.31	24.32	23.38	28.91	28.16	31.66	30.00
Far Western	28.50	20.63	14.51	14.28	16.68	15.04	15.59	16.01	16.37	18.06	20.21	20.07	23.64	18.89
United States	12.48	10.23	8.94	9.35	10.09	10.81	10.82	11.79	11.88	12.06	13.38	15.88	15.20	13.37

CORN—Continued.

Average farm price of corn per bushel in the United States.

State, Territory, or Division.	Price December 1, by decades.				Price December 1, by years.									Price bimonthly, 1910.					
	1866–1875.	1876–1885.	1886–1895.	1896–1905.	1901	1902	1903	1904	1905	1906	1907	1908	1909	Feb. 1.	Apr. 1.	June 1.	Aug. 1.	Oct. 1.	Dec. 1.
	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.
Maine	102	78	68	61	76	74	66	81	69	64	75	84	80	79	78	78	78	75	71
New Hampshire	95	77	66	60	78	73	63	72	69	64	75	79	76	77	76	78	76	79	69
Vermont	94	74	64	57	73	68	62	73	68	59	75	78	73	74	77	72	73	73	66
Massachusetts	92	76	64	60	76	74	66	72	70	60	75	81	81	81	84	80	76	75	70
Rhode Island	99	79	68	68	76	78	81	84	71	64	80	90	97	90	100	98	90	90	83
Connecticut	96	74	64	61	75	74	67	73	71	60	75	80	75	78	75	77	75	75	68
New York	77	63	57	54	72	67	60	64	61	59	71	80	74	73	75	74	76	70	63
New Jersey	69	59	54	49	66	56	57	58	55	53	63	69	71	75	79	77	77	73	60
Pennsylvania	66	57	51	48	62	58	57	59	54	52	64	73	70	74	76	74	74	73	59
North Atlantic	72.3	60.6	53.8	50.5	65.9	60.4	58.2	61.2	56.9	54.4	66.4	74.9	71.8	74.2	76.2	74.5	74.9	72.4	61.0
Delaware	58	49	44	41	57	49	49	49	47	42	52	59	58	68	69	70	68	65	52
Maryland	62	51	46	43	58	51	51	50	48	45	54	62	65	72	74	73	78	72	58
Virginia	57	51	47	47	59	52	53	59	53	55	64	71	74	78	84	83	84	79	65
West Virginia	56	50	50	51	65	54	64	64	53	55	72	77	74	78	81	80	82	79	68
North Carolina	65	57	53	55	73	60	61	62	64	68	74	79	85	90	94	97	96	91	76
South Carolina	90	72	60	62	84	69	69	70	74	73	78	91	90	95	97	98	97	95	82
Georgia	81	68	59	61	82	73	69	71	70	67	76	82	86	92	94	96	97	90	78
Florida	103	80	67	65	85	77	73	75	66	62	80	82	83	86	90	88	93	86	85
South Atlantic	68.3	57.8	52.9	53.3	69.6	60.1	61.4	63.3	60.6	61.1	70.6	77.1	80.3	85.5	88.8	89.6	90.4	85.5	72.9
Ohio	44	43	39	37	57	42	47	46	43	39	52	63	56	62	60	60	63	62	46
Indiana	38	38	36	33	55	36	36	41	38	36	45	60	50	59	57	56	59	55	40
Illinois	34	35	33	33	57	36	36	39	38	36	44	57	52	59	57	54	58	51	38
Michigan	54	46	44	41	52	52	46	52	46	44	55	64	61	65	67	65	68	64	53
Wisconsin	48	40	38	37	52	50	43	46	42	41	55	61	60	63	63	62	64	62	52
N. C. E. of Mississippi River	38.9	37.9	35.6	34.4	55.7	38.5	38.9	41.7	39.4	37.5	47.1	59.7	53.5	60.3	58.7	57.0	60.4	55.7	41.7
Minnesota	46	37	34	31	45	40	38	36	33	34	50	55	49	50	52	48	55	50	45
Iowa	30	27	30	29	52	33	38	33	34	32	43	52	49	54	51	50	55	49	36
Missouri	40	33	33	35	67	33	34	44	37	38	47	57	59	63	65	68	69	60	44
North Dakota	....	....	37	38	46	45	42	40	36	39	60	60	55	60	61	61	64	66	58
South Dakota	....	....	32	30	45	41	35	36	31	29	46	50	50	54	50	52	58	54	40
Nebraska	36	24	29	28	54	30	28	33	32	29	41	51	50	54	51	49	54	48	36
Kansas	42	28	32	33	63	34	36	41	33	32	44	55	54	60	60	60	61	59	45
N. C. W. of Mississippi River	36.0	28.9	31.0	30.9	54.7	33.0	34.5	36.2	33.7	32.5	44.3	53.4	52.3	56.7	55.5	55.4	59.1	53.3	40.1
Kentucky	41	42	40	42	61	42	56	49	43	42	53	65	62	69	75	75	76	73	53
Tennessee	47	42	41	44	65	47	49	50	50	47	57	64	70	78	82	84	87	76	56
Alabama	78	64	55	56	77	67	57	60	64	64	75	83	85	92	95	94	96	84	71
Mississippi	82	63	54	54	74	61	54	56	65	61	75	83	81	87	90	94	88	74	63
Louisiana	84	66	55	54	75	66	58	57	61	60	70	70	69	73	75	82	78	66	55
Texas	67	62	50	49	80	66	48	52	49	50	60	59	76	82	85	85	77	69	63
Oklahoma	....	....	....	39	76	41	38	40	34	31	44	51	55	60	65	64	65	56	51
Arkansas	66	53	47	48	81	49	51	53	55	47	68	66	72	79	85	87	85	62	58
South Central	57.4	50.5	46.3	46.7	72.5	49.9	50.0	50.2	48.2	46.3	58.8	63.3	69.2	75.5	79.7	80.7	79.1	69.0	58.7
Montana	....	88	70	66	90	72	62	68	68	65	68	90	86	90	100	106	125	113	95
Wyoming	....	....	62	61	72	59	58	57	75	59	70	76	78	88	85	85	90	....	66
Colorado	....	82	54	49	74	59	54	54	47	50	65	71	70	69	65	76	71	64	60
New Mexico	....	85	69	67	77	78	75	78	69	72	72	80	90	100	110	88	97	100	90
Arizona	....	84	75	94	90	101	90	91	97	85	90	105	100	119	135	126	91	120	110
Utah	....	77	61	66	90	67	70	72	70	74	72	72	87	80	100	90	85	68	84
Idaho	....	88	65	63	60	62	57	70	66	56	70	70	75	85	80	80	66	85	71
Washington	....	79	62	57	58	65	55	66	60	55	70	76	86	93	90	82	80	80	75
Oregon	88	81	62	60	57	66	67	61	59	65	74	77	80	95	100	101	104	105	80
California	100	79	60	66	68	77	74	78	76	67	85	88	91	90	90	90	80	82	80
Far Western	99.3	80.6	59.7	61.8	72.2	69.7	65.6	66.4	62.2	61.0	73.4	79.2	82.3	89.4	92.0	89.3	84.2	86.1	76.5
United States	47.8	40.1	38.2	37.1	60.5	40.3	42.5	44.1	41.2	39.9	51.6	60.6	59.6	65.2	65.5	65.2	67.2	61.1	48.8

CORN—Continued.

Wholesale prices of corn per bushel, 1897–1910.

Date.	New York.		Baltimore.		Cincinnati.		Chicago.		Detroit.		St. Louis.		San Francisco.	
	No. 2 mixed.		Mixed.[a]		No. 2.		No. 2.		No. 3.[b]		No. 2.		No. 1 white (per 100 lbs.).	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.
	Cts.	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*		
1897	27	38	22	39	22½	33½	21¾	32⅝	21½	32½	19¼	29½	$0.77½	$1.12½
1898	33	44¼	29	43½	29	40	26	38	28½	39½	25¼	36¼	.85	1.17½
1899	36½	45⅝	34¾	43	31½	38	30	38⅛	32	38	29½	36¼	1.05	1.17½
1900	39⅞	52⅛	36⅝	48¾	32¾	47	30½	49½	32½	45	30½	43	1.00	1.30
1901	45½	72⅞	41½	68	38	71½	36	67½	37	70½	35	70	1.10	1.75
1902	57	73	43	77	44	69	43¾	88	57	70½	40½	69¼	1.30	1.65
1903	49¼	68½	46½	61	40	54½	41	53	40½	56½	39	55	1.17½	1.57½
1904	47⅛	69	49¼	58¾	45½	58½	42¾	59½	42	60	42½	57	1.25	1.55
1905	50¾	63½	42	65	44½	59½	42	64½	44¾	59	41½	58½	1.25	1.55
1906	47	61½	45⅝	58	42	55½	39	54¾	43	55	39½	54½	......	......
1907.														
January	49½	52	47	50	43	47	39¾	43½	43	46	39	43	1.25	1.40
February	51¾	54½	49⅝	51⅛	46	48	43	44¼	45¾	46½	42½	45½	1.25	1.35
March	51¾	54	49⅛	51	46½	48¼	43	45	45	47	43	45½	1.27½	1.35
April	51¾	57¾	50½	56⅞	47½	53½	44¼	50¾	45½	50½	43	50½	1.27½	1.40
May	56½	63	55⅞	60¾	52½	57½	49½	56	50½	56¼	49	55½	1.35	1.55
June	60½	65	58⅛	60⅝	55	56½	51¾	54½	53½	56½	50¾	54	......	......
July	60	63	58	61½	55½	57	52	55¼	54¾	57	51¾	55	1.50	1.60
August	60¼	67⅝	59	63¾	56½	63	54	61½	57	62	53¼	60	1.50	1.57½
September	67¼	77	64	70	63	66	60½	63¾	62	69½	59	63	1.52½	1.60
October	69	76⅛	64	74¼	58	71	55¾	66½	63	69½	53½	66	......	......
November	64½	71¼	61¼	67	59	62½	55½	60½	62	64	56	59½	......	......
December	67	76	59¾	68½	60	61½	57½	61½	58	64½	51½	59	......	......
Year	49½	77	47	74¼	43	71	39¾	66½	43	69½	39	66	1.25	1.60
1908.							(c)							
January	63½	69½	59⅞	65¾	55½	56	57	60	54½	59½	54¼	57½	......	......
February	60½	63¼	59⅜	61½	54½	60½	56½	59½	53½	61½	54¼	59	......	......
March	62½	70	62	66⅞	60½	66½	58½	66	61½	65½	58½	64½	1.60	1.70
April	69¼	75	66½	71	66½	69½	65	68	65	68½	63	67	1.65	1.70
May	72½	77½	71¼	74½	69½	76	67¾	82	69	75	67	73¾	1.65	1.80
June	74½	78	73½	76	70½	74½	67¼	74¼	71½	75	70½	75	1.80	1.87½
July	78¼	85	75½	80	71	81½	70½	78	72	79	74	81¼	1.80	1.90
August	......	......	80	83½	76½	82	77½	80	78½	80	76	79½	1.85	1.90
September	......	......	......	......	79½	83½	78	82	80	83	76½	81½	......	......
October	......	......	......	......	66½	79½	66	79	75	80	63½	77	1.85	1.90
November	71	74	67¾	71	63	66	62	66½	63	72	61	66½	......	......
December	65	71	63⅜	67½	58½	64	56¾	62¼	59	63	56¼	63	......	......
Year	60½	85	59⅜	83½	54½	83½	56½	82	53½	83	54¼	81½	1.60	1.90
1909.														
January	66¼	68½	64½	67	61	62½	58¼	60¾	60½	62½	58	62	1.72½	1.75
February	68¾	73	67⅛	71¾	61½	68½	61	65½	62½	67½	61	65	......	......
March	72½	74¾	70½	73¼	66½	69	64	67½	66¼	68½	64¼	67¼	......	......
April	74¼	80	72⅞	79	68½	76½	66½	72½	68	75	66	74½	1.90	1.95
May	80	82	78⅞	82	76	78	72¼	76	75	79	73	77	1.85	1.95
June	79	83	76⅜	81¼	74	77	71½	77	75¾	77½	71½	75½	......	......
July	77	80	74	77½	72	75½	68	74¼	73	75½	67½	74½	......	......
August	......	......	72	76	69	74	66½	70	71¼	74	64	69	1.80	1.85
September	......	......	74	74½	65½	72	63	69¾	66	74	62¾	69½	......	......
October	68¾	72	64¾	68¼	61	66	59	62	62½	65	59	63¼	......	......
November	69½	73	64¼	69	57	63½	61¼	64½	60½	64	58	63	1.80	1.85
December	66	69½	63½	67¼	57	64	62½	66	59	63¼	58	63¾	1.75	1.85
Year	66	83	63½	82	57	78	58¼	77	59	79	58	77	1.72½	1.95
1910.														
January	69	74	67	70½	63½	69½	62½	68	63½	68¼	63	68	1.75	1.85
February	68½	73¼	66¾	69⅝	61½	66	63	66½	63	66	63	65	1.80	1.85
March	64½	68½	62½	67	59	63½	60	65	59½	63	59½	63	1.75	1.80
April	62¼	65	60⅜	64½	58	63½	56½	61	58½	61½	59	64½	1.62½	1.75
May	65½	69	61½	64½	60	66	56	63	58	64	59	66½	1.65	1.75
June	65	69	61	63	60½	63	57½	60½	60	63½	58½	62	1.60	1.67½
July	......	......	62	70½	62	67½	59¾	66¼	62¾	64	59	67½	1.62½	1.72½
August	......	......	66	70¼	61½	67½	58¾	67½	62	67½	59	68	1.70	1.72½
September	60	65½	58	65½	53½	61½	50¾	60	53	61	51½	59	1.60	1.70
October	55½	61	54	58	49½	54½	47½	52½	51	53	48	54	1.62½	1.65
November	52¼	59	52	53½	50½	55½	47½	52	51½	53½	45	50½	1.40	1.45
December	52	57	50	53¼	46	54	45½	50	46½	54	44	50½	1.40	1.45
Year	52	74	50	70½	46	69½	45½	68	46½	68¼	44	68	1.40	1.85

[a] No. 2 grade, 1897 to 1900. [b] No. 2 grade, 1897 to 1904. [c] Contract.

CORN—Continued.

International trade in corn, including corn meal, 1905–1909.

General Note.—Substantially the international trade of the world. It should not be expected that the world export and import totals for any year will agree. Among sources of disagreement are these: (1) Different periods of time covered in the "year" of the various countries; (2) imports received in year subsequent to year of export; (3) want of uniformity in classification of goods among countries; (4) different practices and varying degrees of failure in recording countries of origin and ultimate destination; (5) different practices of recording reexported goods; (6) opposite methods of treating free ports; (7) clerical errors, which, it may be assumed, are not infrequent.

The exports given are domestic exports, and the imports given are imports for consumption as far as it is feasible and consistent so to express the facts. While there are some inevitable omissions, on the other hand, there are some duplications because of reshipments that do not appear as such in official reports. For the United Kingdom import figures refer to imports for consumption, when available, otherwise total imports less exports of "foreign and colonial merchandise." Figures for the United States include Alaska, Porto Rico, and Hawaii.

EXPORTS.

Country.	Year beginning—	1905.	1906.	1907.	1908.	1909.
		Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Argentina	Jan. 1	87,487,629	106,047,790	50,262,705	67,390,728	89,499,359
Austria-Hungary	Jan. 1	63,218	22,361	120,144	381,821	48,218
Belgium	Jan. 1	8,078,215	6,588,557	7,644,848	6,134,920	7,088,377
Bulgaria	Jan. 1	3,870,090	5,658,543	10,225,452	4,393,880	5,009,230
Netherlands	Jan. 1	4,278,515	6,010,176	8,215,931	6,957,524	7,308,873
Roumania	Jan. 1	1,441,437	23,756,349	54,721,194	28,960,339	a 29,091,447
Russia	Jan. 1	7,372,386	9,879,982	38,636,221	23,545,045	a 26,531,945
Servia	Jan. 1	806,115	1,755,446	4,046,392	1,934,483	3,767,180
United States	Jan. 1	113,189,271	105,258,629	86,524,012	39,013,273	38,114,100
Uruguay	July 1	28,519	9,746	88,659	25,432	399,229
Other countries		4,199,950	2,713,077	5,214,098	9,455,000	a 11,739,000
Total		230,815,345	267,700,656	265,699,656	188,192,445	218,596,958

IMPORTS.

Country.	Year beginning—	1905.	1906.	1907.	1908.	1909.
Austria-Hungary	Jan. 1	18,511,368	7,198,839	4,002,712	3,106,663	4,050,645
Belgium	Jan. 1	24,169,780	20,125,507	23,505,832	19,158,096	22,099,848
British South Africa b	Jan. 1	3,448,954	315,835	51,298	145,275	155,389
Canada	Jan. 1	11,898,604	12,714,257	16,187,579	6,812,833	7,563,688
Cuba	Jan. 1	1,843,348	2,489,087	3,153,495	1,837,974	2,249,996
Denmark	Jan. 1	10,859,257	18,855,752	2,383,282	10,445,555	9,151,750
Egypt	Jan. 1	1,279,749	1,438,435	196,539	845,205	748,865
France	Jan. 1	11,122,512	14,509,103	16,850,618	9,629,979	11,213,413
Germany c	Jan. 1	36,538,366	44,883,052	49,293,029	26,372,295	27,833,917
Italy	Jan. 1	5,902,875	8,666,763	2,815,120	2,987,496	8,459,986
Mexico	Jan. 1	1,115,007	1,882,218	1,554,145	179,157	1,167,733
Netherlands	Jan. 1	16,234,785	25,305,233	29,192,195	25,261,400	22,914,269
Norway	Jan. 1	544,596	718,276	1,937,926	809,841	965,347
Portugal	Jan. 1	2,724,050	370,611	577,726	2,015,388	2,367,800
Russia	Jan. 1	163,979	456,481	550,841	355,769	a 174,760
Spain	Jan. 1	1,904,186	2,647,975	4,552,178	3,320,040	6,411,009
Sweden	Jan. 1	491,035	564,946	330,588	488,077	272,284
Switzerland	Jan. 1	2,498,380	2,887,291	2,867,764	2,480,164	3,143,216
United Kingdom	Jan. 1	84,156,490	97,736,853	106,708,048	68,186,271	78,057,368
Other countries		7,432,369	4,812,269	3,163,038	2,909,000	a 1,785,000
Total		242,839,690	268,578,783	269,873,953	187,346,478	210,786,283

a Preliminary.
b Cape Colony and Transvaal before 1906.
c Not including free ports prior to March 1, 1906.

Condition of the corn crop in the United States on the first of months named, 1890–1910.

Year.	July.	Aug.	Sept.	Oct.	Year.	July.	Aug.	Sept.	Oct.	Year.	July.	Aug.	Sept.	Oct.
	P. ct.	*P. ct.*	*P. ct.*	*P. ct.*		*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*		*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
1890	93.1	73.3	70.1	70.6	1897	82.9	84.2	79.3	77.1	1904	86.4	87.3	84.6	83.9
1891	92.8	90.8	91.1	92.5	1898	90.5	87.0	84.1	82.0	1905	87.3	89.0	89.5	89.2
1892	81.1	82.5	79.6	79.8	1899	86.5	89.9	85.2	82.7	1906	87.5	88.0	90.2	90.1
1893	93.2	87.0	76.7	75.1	1900	89.5	87.5	80.6	78.2	1907	80.2	82.8	80.2	78.0
1894	95.0	69.1	63.4	64.2	1901	81.3	54.0	51.7	52.1	1908	82.8	82.5	79.4	77.8
1895	99.3	102.5	96.4	95.5	1902	87.5	86.5	84.3	79.6	1909	89.3	84.4	74.6	73.8
1896	92.4	96.0	91.0	90.5	1903	79.4	78.7	80.1	80.8	1910	85.4	79.3	78.2	80.3

CORN—Continued.

Average farm price of corn per bushel, on the first of each month, 1909–1910.

Month.	United States.		North Atlantic States.		South Atlantic States.		N. Cen. States East of Miss. R.		N. Cen. States West of Miss. R.		South Central States.		Far Western States.	
	1910.	1909.	1910.	1909.	1910.	1909.	1910.	1909.	1910.	1909.	1910.	1909.	1910.	1909.
	Cts.	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*
January	62.3	60.7	72.5	72.3	81.8	78.5	56.3	59.2	54.9	53.1	72.4	64.8	90.7	79.7
February	65.2	61.4	74.2	71.2	85.5	78.9	60.3	59.6	56.7	53.5	75.5	66.4	89.4	78.7
March	65.9	64.7	76.0	74.2	87.5	82.1	60.5	63.0	56.2	56.4	78.2	70.2	91.5	84.7
April	65.5	67.5	76.2	75.6	88.8	85.3	58.7	65.0	55.5	58.8	79.7	74.7	92.0	88.7
May	63.5	71.9	73.9	78.1	88.8	89.7	55.8	68.4	52.8	63.7	79.2	79.4	88.1	94.7
June	65.2	76.3	74.5	81.5	89.6	94.3	57.0	73.1	55.4	67.8	80.7	84.2	89.3	95.1
July	66.2	77.0	73.9	84.4	90.7	97.4	58.8	73.4	56.9	67.6	80.2	85.4	85.1	99.9
August	67.2	75.2	74.9	83.2	90.4	96.3	60.4	72.8	59.1	65.5	79.1	82.3	84.2	94.6
September	66.3	71.0	75.1	79.0	89.4	93.5	60.6	69.4	58.4	61.4	75.7	76.6	91.5	85.7
October	61.1	67.1	72.4	81.0	85.5	87.8	55.7	64.5	53.3	58.4	69.0	72.3	86.1	85.7
November	52.6	62.2	65.5	73.7	76.1	82.5	47.6	55.9	44.0	54.1	61.2	70.8	81.5	84.9
December	48.8	59.6	61.0	71.8	72.9	80.3	41.7	53.5	40.1	52.3	58.7	69.2	76.5	82.3

WHEAT.

Wheat area of countries named, 1906–1910.

Country.	1906.	1907.	1908.	1909.	1910.
NORTH AMERICA.	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*
United States	47,305,800	45,211,000	47,557,000	46,723,000	49,205,000
Canada:					
New Brunswick	20,800	20,600	20,200	19,600	19,500
Ontario	959,000	820,700	812,400	705,800	729,500
Manitoba	3,141,500	2,789,500	2,957,000	2,808,000	3,014,400
Saskatchewan	1,730,600	2,047,700	2,396,000	3,685,000	4,848,000
Alberta	177,100	207,900	271,000	385,000	533,000
Other	(a)	164,000	153,700	147,000	150,400
Total Canada	....	6,050,400	6,610,300	7,750,400	9,294,800
Mexico	(a)	(a)	(a)	(a)	(a)
SOUTH AMERICA.					
Argentina	14,023,600	14,065,600	14,232,900	14,981,900	14,422,100
Chile	(a)	(a)	1,142,800	1,106,600	1,179,300
Uruguay	712,800	623,300	611,800	683,900	(a)
EUROPE.					
Austria-Hungary:					
Austria	2,869,700	2,914,500	2,959,600	2,942,100	2,998,800
Hungary proper	8,785,400	8,069,300	8,715,000	8,036,500	8,728,700
Croatia-Slavonia	735,700	708,000	758,800	762,200	804,400
Bosnia-Herzegovina	324,400	247,900	272,100	205,100	247,100
Total Austria-Hungary	12,715,200	11,939,700	12,705,500	11,945,900	12,779,000
Belgium	370,800	392,500	377,600	(a)	(a)
Bulgaria	2,494,800	2,414,700	2,422,700	2,570,200	2,721,800
Denmark	100,900	100,100	100,800	100,800	103,800
Finland	(a)	(a)	(a)	(a)	(a)
France	16,103,200	16,253,200	16,220,800	16,299,300	16,120,100
Germany	4,783,900	4,316,400	4,656,900	4,525,400	4,800,900
Greece	(a)	(a)	(a)	(a)	(a)
Italy	12,692,900	12,923,200	12,621,100	11,635,900	11,758,500
Montenegro	(a)	(a)	(a)	(a)	(a)
Netherlands	140,300	134,500	139,000	126,700	131,900
Norway	(a)	12,400	12,400	12,400	12,400
Portugal	(a)	(a)	(a)	(a)	(a)
Roumania	4,998,500	4,236,100	4,452,000	4,173,000	4,814,000

a No official statistics of area; estimates of production on p. 510.

WHEAT—Continued.

Wheat area of countries named, 1906–1910—Continued.

Country.	1906.	1907.	1908.	1909.	1910.
EUROPE—continued.					
Russia:	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*
Russia proper	49,017,000	45,574,000	46,607,700	47,406,400	....
Poland	1,259,700	1,245,700	1,218,700	1,227,200	....
Northern Caucasia	8,304,300	8,124,900	7,958,600	8,376,800	....
Total Russia (European)	58,581,000	54,944,600	55,785,000	57,010,400	62,620,900
Servia	921,400	908,400	931,300	(a)	(a)
Spain	9,298,300	9,137,700	9,283,000	9,347,200	9,413,200
Sweden	212,100	216,900	224,900	228,600	222,400
Switzerland	(a)	(a)	106,300	104,800	104,800
Turkey (European)	(a)	(a)	(a)	(a)	1,061,200
United Kingdom:					
Great Britain—					
England	1,661,100	1,537,200	1,548,700	1,734,200	1,716,600
Scotland	50,100	48,300	43,400	49,700	52,800
Wales	44,400	39,900	34,600	39,600	39,400
Ireland	43,900	38,200	36,700	43,600	47,600
Total United Kingdom	1,799,500	1,663,600	1,663,400	1,867,100	1,856,400
ASIA.					
British India, including such native States as report	26,357,400	29,212,500	22,824,500	26,149,300	27,919,400
Cyprus	(a)	(a)	(a)	(a)	(a)
Japanese Empire:					
Japan	1,086,100	1,088,400	1,101,800	1,107,900	(a)
Formosa	(a)	(a)	(a)	(a)	(a)
Persia	(a)	(a)	(a)	(a)	(a)
Russia:					
Central Asia	1,237,600	2,016,200	2,155,200	3,322,200	....
Siberia	3,806,000	3,868,300	4,470,700	5,073,100	....
Transcaucasia	10,000	8,100	7,800	9,000	....
Total Russia (Asiatic)	5,053,600	5,892,600	6,633,700	8,404,300	8,442,000
Turkey (Asiatic)	(a)	(a)	(a)	(a)	(a)
AFRICA.					
Algeria	3,315,400	3,257,400	3,597,000	2,814,200	3,426,500
Egypt	1,266,500	1,264,600	1,212,600	1,296,700	1,296,700
Sudan (Anglo-Egyptian)	(a)	(a)	(a)	(a)	(a)
Tunis	1,005,700	1,099,600	1,087,300	999,800	1,112,000
Union of South Africa	(a)	(a)	(a)	(a)	(a)
AUSTRALASIA.					
Australia:					
Queensland	119,400	114,600	82,500	80,900	117,200
New South Wales	1,939,400	1,866,200	1,390,200	1,394,100	1,990,200
Victoria	2,070,500	2,031,900	1,847,100	1,779,900	2,097,200
South Australia	1,757,000	1,686,400	1,730,500	1,693,500	1,895,700
Western Australia	195,100	250,300	279,600	285,000	448,900
Tasmania	41,300	32,800	30,800	29,100	37,100
Total Australia	6,122,700	5,982,200	5,360,700	5,262,500	6,586,300
New Zealand	223,600	212,100	193,000	252,400	311,000
Total Australasia	6,346,300	6,194,300	5,553,700	5,514,900	6,897,300

[a] No official statistics of area; estimates of production on p. 510.

WHEAT—Continued.

Wheat crop of countries named, 1906–1910.

Country.	1906.	1907.	1908.	1909.	1910.
NORTH AMERICA.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
United States	735,261,000	634,087,000	664,602,000	737,189,000	695,443,000
Canada:					
New Brunswick	407,000	411,000	349,000	395,000	371,000
Ontario	22,109,000	18,019,000	18,057,000	16,262,000	17,805,000
Manitoba	61,250,000	39,688,000	50,269,000	52,706,000	41,159,000
Saskatchewan	37,040,000	27,692,000	34,742,000	85,197,000	81,139,000
Alberta	3,966,000	4,194,000	6,842,000	9,579,000	6,593,000
Other	3,000,000	2,687,000	2,175,000	2,605,000	2,923,000
Total Canada	127,772,000	92,691,000	112,434,000	166,744,000	149,990,000
Mexico	12,862,000	10,000,000	10,000,000	10,000,000	10,000,000
Total	875,895,000	736,778,000	787,036,000	913,933,000	855,433,000
SOUTH AMERICA.					
Argentina	134,931,000	155,993,000	192,489,000	156,162,000	131,010,000
Chile	12,157,000	15,776,000	18,967,000	17,743,000	19,743,000
Uruguay	4,606,000	6,867,000	7,430,000	8,595,000	9,000,000
Total	151,694,000	178,636,000	218,886,000	182,500,000	159,753,000
EUROPE.					
Austria-Hungary:					
Austria	58,255,000	52,369,000	62,129,000	58,468,000	57,589,000
Hungary proper	197,409,000	120,509,000	152,205,000	113,352,000	181,145,000
Croatia-Slavonia	10,351,000	10,170,000	13,220,000	11,662,000	13,489,000
Bosnia-Herzegovina	2,693,000	2,169,000	3,023,000	2,594,000	2,939,000
Total Austria-Hungary	268,708,000	185,217,000	230,577,000	186,076,000	255,162,000
Belgium	12,964,000	15,835,000	13,393,000	15,506,000	14,000,000
Bulgaria	39,109,000	23,545,000	36,496,000	32,071,000	49,126,000
Denmark	4,161,000	4,343,000	4,318,000	3,829,000	4,737,000
Finland	151,000	140,000	135,000	135,000	135,000
France	324,919,000	376,999,000	317,765,000	356,193,000	268,364,000
Germany	144,754,000	127,843,000	138,442,000	138,000,000	141,884,000
Greece	8,000,000	8,000,000	8,000,000	7,000,000	7,000,000
Italy	176,464,000	177,543,000	152,236,000	189,959,000	153,337,000
Montenegro	200,000	200,000	200,000	200,000	200,000
Netherlands	4,942,000	5,325,000	5,121,000	4,158,000	4,324,000
Norway	303,000	290,000	333,000	313,000	294,000
Portugal	9,000,000	6,000,000	5,000,000	5,000,000	6,000,000
Roumania	113,867,000	42,257,000	54,813,000	56,751,000	110,761,000
Russia:					
Russia proper	344,765,000	340,416,000	383,016,000	586,819,000	....
Poland	21,152,000	18,173,000	21,182,000	21,194,000	....
Northern Caucasia	85,046,000	79,184,000	84,964,000	103,465,000	....
Total Russia (European)	450,963,000	437,773,000	489,162,000	711,478,000	699,413,000
Servia	13,211,000	8,375,000	11,495,000	13,962,000	10,000,000
Spain	140,656,000	100,331,000	119,970,000	144,105,000	137,448,000
Sweden	6,650,000	6,279,000	6,756,000	6,978,000	7,450,000
Switzerland	4,000,000	4,000,000	3,527,000	3,568,000	3,417,000
Turkey (European)	25,000,000	18,000,000	20,000,000	20,000,000	19,462,000
United Kingdom:					
Great Britain—					
England	57,583,000	53,855,000	51,371,000	60,121,000	55,067,000
Scotland	2,063,000	1,953,000	1,854,000	2,111,000	2,088,000
Wales	1,308,000	1,138,000	966,000	1,147,000	1,146,000
Ireland	1,575,000	1,367,000	1,438,000	1,809,000	1,716,000
Total United Kingdom	62,529,000	58,313,000	55,629,000	65,188,000	60,017,000
Total	1,810,551,000	1,606,608,000	1,673,368,000	1,960,470,000	1,952,531,000

WHEAT—Continued.

Wheat crop of countries named, 1906-1910—Continued.

Country.	1906.	1907.	1908.	1909.	1910.
ASIA.					
	Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
British India, including such native States as report	319,952,000	317,023,000	227,983,000	284,361,000	357,941,000
Cyprus	2,410,000	2,636,000	2,601,000	2,600,000	2,600,000
Japanese Empire:					
Japan	20,283,000	22,932,000	22,587,000	23,010,000	20,129,000
Formosa	178,000	200,000	200,000	200,000	200,000
Total Japanese Empire	20,461,000	23,132,000	22,787,000	23,210,000	20,329,000
Persia	16,000,000	16,000,000	16,000,000	16,000,000	16,000,000
Russia:					
Central Asia	11,486,000	27,085,000	21,416,000	26,429,000	....
Siberia	45,833,000	45,771,000	55,755,000	45,269,000	....
Transcaucasia	108,000	63,000	66,000	94,000	....
Total Russia (Asiatic)	57,427,000	72,919,000	77,237,000	71,792,000	76,282,000
Turkey (Asiatic)	35,000,000	35,000,000	35,000,000	35,000,000	35,000,000
Total	451,250,000	466,710,000	381,608,000	432,963,000	508,152,000
AFRICA.					
Algeria	34,323,000	31,261,000	29,739,000	34,769,000	39,374,000
Egypt	25,000,000	25,000,000	25,000,000	25,000,000	25,000,000
Sudan (Anglo-Egyptian)	542,000	500,000	500,000	500,000	500,000
Tunis	4,906,000	6,314,000	2,838,000	6,430,000	5,512,000
Union of South Africa	2,500,000	2,500,000	2,500,000	2,500,000	2,500,000
Total	67,271,000	65,575,000	60,577,000	69,199,000	72,886,000
AUSTRALASIA.					
Australia:					
Queensland	1,173,000	1,144,000	715,000	1,241,000	1,621,000
New South Wales	21,391,000	22,506,000	9,444,000	15,971,000	29,431,000
Victoria	24,156,000	23,331,000	12,482,000	24,082,000	29,687,000
South Australia	20,778,000	18,017,000	19,739,000	20,009,000	25,926,000
Western Australia	2,381,000	2,845,000	3,018,000	2,535,000	5,779,000
Tasmania	801,000	672,000	665,000	825,000	819,000
Total Australia	70,680,000	68,515,000	46,063,000	64,663,000	93,263,000
New Zealand	7,013,000	5,782,000	5,743,000	9,049,000	8,934,000
Total Australasia	77,693,000	74,297,000	51,806,000	73,712,000	102,197,000
Grand total	3,434,354,000	3,128,604,000	3,173,281,000	3,632,777,000	3,650,952,000

WHEAT—Continued.

Acreage, production, value, prices, and exports of wheat in the United States, 1849–1910.

Year.	Acreage harvested.	Average yield per acre.	Production.	Average farm price per bushel December 1.	Farm value December 1.	Chicago cash price per bushel, No. 1 northern. December. Low.	December. High.	May of following year. Low.	May of following year. High.	Domestic exports, including flour, fiscal year beginning July 1.	Per cent of crop exported.
	Acres.	*Bush.*	*Bushels.*	*Cents.*	*Dollars.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Bushels.*	*P. ct.*
1849 a	....	......	100,486,000	......	....	......	......	......	......	7,535,901	7.5
1859 a	....	......	173,105,000	......	....	......	......	......	......	17,213,133	9.9
1866	15,424,000	9.9	152,000,000	152.7	232,110,000	129	145	185	211	12,646,941	8.3
1867	18,322,000	11.6	212,441,000	145.2	308,387,000	126	140	134	161	26,323,014	12.4
1868	18,460,000	12.1	224,037,000	108.5	243,033,000	80	88	87	96	29,717,201	13.3
1869	19,181,000	13.6	260,147,000	76.5	199,025,000	63	76	79	92	53,900,780	20.7
1870	18,993,000	12.4	235,885,000	94.4	222,767,000	91	98	113	120	52,574,111	22.3
1871	19,944,000	11.6	230,722,000	114.5	264,076,000	107	111	120	143	38,995,755	16.9
1872	20,858,000	11.9	249,997,000	111.4	278,522,000	97	108	112	122	52,014,715	20.8
1873	22,172,000	12.7	281,255,000	106.9	300,670,000	96	106	105	114	91,510,398	32.5
1874	24,967,000	12.3	308,103,000	86.3	265,881,000	78	83	78	94	72,912,817	23.7
1875	26,382,000	11.1	292,136,000	89.5	261,397,000	82	91	89	100	74,750,682	25.6
1876	27,627,000	10.5	289,356,000	97.0	280,743,000	104	117	130	172	57,043,936	19.7
1877	26,278,000	13.9	364,194,000	105.7	385,089,000	103	108	98	113	92,141,626	25.3
1878	32,109,000	13.1	420,122,000	77.6	325,814,000	81	84	91	102	150,502,506	35.8
1879	32,546,000	13.8	448,757,000	110.8	497,030,000	122	133½	112½	119	180,304,181	40.2
1880	37,987,000	13.1	498,550,000	95.1	474,202,000	93½	109¾	101	112⅝	186,321,514	37.4
1881	37,709,000	10.2	383,280,000	119.2	456,880,000	124¾	129	123	140	121,892,389	31.8
1882	37,067,000	13.6	504,185,000	88.4	445,602,000	91⅛	94¾	108	113⅝	147,811,316	29.3
1883	36,456,000	11.6	421,086,000	91.1	383,649,000	94⅝	99¼	85	94¾	111,534,182	26.5
1884	39,476,000	13.0	512,765,000	64.5	330,862,000	69½	76⅜	85⅜	90¾	132,570,366	25.9
1885	34,189,000	10.4	357,112,000	77.1	275,320,000	82⅞	89	72⅛	79	94,565,793	26.5
1886	36,806,000	12.4	457,218,000	68.7	314,226,000	75⅛	79½	80¾	88¾	153,804,969	33.6
1887	37,642,000	12.1	456,329,000	68.1	310,613,000	75⅛	79¼	81¼	89⅞	119,625,344	26.2
1888	37,336,000	11.1	415,868,000	92.6	385,248,000	96⅝	105½	77¼	95½	88,600,743	21.3
1889	38,124,000	12.9	490,560,000	69.8	342,492,000	76¾	80½	89¾	100	109,430,467	22.3
1890	36,087,000	11.1	399,262,000	83.8	334,774,000	87½	92¾	98⅞	108¼	106,181,316	26.6
1891	39,917,000	15.3	611,780,000	83.9	513,473,000	89⅜	93¼	80	85¾	225,665,811	36.9
1892	38,554,000	13.4	515,949,000	62.4	322,112,000	69½	73	68¼	76¼	191,912,635	37.2
1893	34,629,000	11.4	396,132,000	53.8	213,171,000	59⅛	64½	52⅛	60½	164,283,129	41.5
1894	34,882,000	13.2	460,267,000	49.1	225,902,000	52¾	63⅝	60¾	85⅜	144,812,718	31.5
1895	34,047,000	13.7	467,103,000	50.9	237,939,000	53¾	64¾	57⅛	67⅝	126,443,968	27.1
1896	34,619,000	12.4	427,684,000	72.6	310,598,000	74⅝	93⅛	68¾	97⅞	145,124,972	33.9
1897	39,465,000	13.4	530,149,000	80.8	428,547,000	92	109	117	185	217,306,005	41.0
1898	44,055,000	15.3	675,149,000	58.2	392,770,000	62¾	70	68⅜	79½	222,618,420	33.0
1899	44,593,000	12.3	547,304,000	58.4	319,545,000	64	69½	63⅝	67½	186,096,762	34.0
1900	42,495,000	12.3	522,230,000	61.9	323,515,000	69¼	74⅝	70	75⅛	215,990,073	41.4
1901	49,896,000	15.0	748,460,000	62.4	467,360,000	73	79½	72⅜	76¼	234,772,516	31.4
1902	46,202,000	14.5	670,063,000	63.0	422,224,000	71⅞	77¾	74¾	80⅝	202,905,598	30.3
1903	49,465,000	12.9	637,822,000	69.5	443,025,000	77¾	87	87¾	101½	120,727,613	18.9
1904	44,075,000	12.5	552,400,000	92.4	510,490,000	115	122	89½	113¾	44,112,910	8.0
1905	47,854,000	14.5	692,979,000	74.8	518,373,000	82½	90	80¼	87¼	97,609,007	14.1
1906	47,306,000	15.5	735,261,000	66.7	490,333,000	b 72⅝	b 75	84	106	146,700,425	20.0
1907	45,211,000	14.0	634,087,000	87.4	554,437,000	b 104¼	b 109	b 103	b 111¼	163,043,669	25.7
1908	47,557,000	14.0	664,602,000	92.8	616,826,000	106½	112	126½	137	114,268,468	17.2
1909	46,723,000	15.8	737,189,000	99.0	730,046,000	106	119¾	100	119¼	87,364,318	11.9
1910	49,205,000	14.1	695,443,000	89.4	621,443,000	104	110	......	......	....	......

a Census figures of production.

b No. 2 red winter.

WHEAT—Continued.

Acreage, production, and farm value December 1 of winter and spring wheat, by States, in 1910, and United States totals, 1890 to 1909.

State, Territory, and year.	Winter wheat.					Spring wheat.				
	Acreage.	Average yield per acre.	Production.	Average farm price Dec. 1.	Farm value Dec. 1.	Acreage.	Average yield per acre.	Production.	Average farm price Dec. 1.	Farm value Dec. 1.
	Acres.	*Bu.*	*Bu.*	*Cts.*	*Dollars.*	*Acres.*	*Bu.*	*Bu.*	*Cts.*	*Dollars.*
Me.						9,000	29.7	267,000	102	272,000
Vt.						1,000	29.3	29,000	103	30,000
N. Y.	444,000	23.7	10,523,000	96	10,102,000					
N. J.	111,000	18.5	2,053,000	98	2,012,000					
Pa.	1,556,000	17.8	27,697,000	92	25,481,000					
Del.	122,000	17.0	2,074,000	90	1,867,000					
Md.	794,000	17.4	13,816,000	92	12,711,000					
Va.	795,000	12.8	10,176,000	97	9,871,000					
W. Va.	410,000	12.5	5,125,000	102	5,228,000					
N. C.	652,000	11.4	7,433,000	110	8,176,000					
S. C.	453,000	11.0	4,983,000	126	6,279,000					
Ga.	260,000	10.5	2,730,000	130	3,549,000					
Ohio	1,944,000	16.2	31,493,000	90	28,344,000					
Ind.	2,627,000	15.6	40,981,000	87	35,653,000					
Ill.	2,100,000	15.0	31,500,000	88	27,720,000					
Mich.	869,000	18.0	15,642,000	89	13,921,000					
Wis.	67,000	20.0	1,340,000	92	1,233,000	124,000	18.7	2,319,000	92	2,133,000
Minn.						5,880,000	16.0	94,080,000	94	88,435,000
Iowa	180,000	21.2	3,816,000	85	3,244,000	350,000	20.9	7,315,000	85	6,218,000
Mo.	1,821,000	13.8	25,130,000	87	21,863,000					
N. Dak.						7,221,000	5.0	36,105,000	90	32,494,000
S. Dak.						3,650,000	12.8	46,720,000	89	41,581,000
Nebr.	2,100,000	16.5	34,650,000	80	27,720,000	350,000	13.9	4,865,000	80	3,892,000
Kans.	4,300,000	14.2	61,060,000	84	51,290,000	120,000	8.4	1,008,000	84	847,000
Ky.	750,000	12.8	9,600,000	93	8,928,000					
Tenn.	910,000	11.7	10,647,000	98	10,434,000					
Ala.	130,000	12.0	1,560,000	113	1,763,000					
Miss.	5,000	14.0	70,000	116	81,000					
Tex.	1,252,000	15.0	18,780,000	98	18,404,000					
Okla.	1,556,000	16.3	25,363,000	87	22,066,000					
Ark.	195,000	13.9	2,710,000	94	2,547,000					
Mont.	285,000	22.0	6,270,000	86	5,392,000	195,000	22.0	4,290,000	86	3,689,000
Wyo.	42,000	25.0	1,050,000	95	998,000	65,000	25.0	1,625,000	95	1,544,000
Colo.	104,000	23.0	2,392,000	82	1,961,000	289,000	21.9	6,329,000	82	5,190,000
N. Mex.						43,000	20.0	860,000	100	860,000
Ariz.						17,000	22.3	379,000	120	455,000
Utah	155,000	20.5	3,178,000	84	2,670,000	100,000	25.3	2,530,000	84	2,125,000
Nev.						40,000	29.0	1,160,000	109	1,264,000
Idaho	345,000	23.7	8,176,000	72	5,887,000	217,000	20.4	4,427,000	72	3,187,000
Wash.	676,000	20.5	13,858,000	78	10,809,000	810,000	14.5	11,745,000	78	9,161,000
Oreg.	467,000	23.7	11,068,000	84	9,297,000	297,000	18.0	5,346,000	84	4,491,000
Cal.	950,000	18.0	17,100,000	94	16,074,000					
U. S.	29,427,000	15.8	464,044,000	89.1	413,575,000	19,778,000	11.7	231,399,000	89.8	207,868,000
1909	28,330,000	15.8	446,366,000	102.9	459,154,000	18,393,000	15.8	290,823,000	93.1	270,892,000
1908	30,349,000	14.4	437,908,000	93.7	410,330,000	17,208,000	13.2	226,694,000	91.1	206,496,000
1907	28,132,000	14.6	409,442,000	88.2	361,217,000	17,079,000	13.2	224,645,000	86.0	193,220,000
1906	29,600,000	16.7	492,888,000	68.3	336,435,000	17,706,000	13.7	242,373,000	63.5	153,898,000
1905	29,864,000	14.3	428,462,000	78.2	334,987,000	17,990,000	14.7	264,517,000	69.3	183,386,000
1904	26,866,000	12.4	332,935,000	97.8	325,611,000	17,209,000	12.8	219,464,000	84.2	184,879,000
1903	32,511,000	12.3	399,867,000	71.6	286,243,000	16,954,000	14.0	237,955,000	65.9	156,782,000
1902	28,581,000	14.4	411,789,000	64.8	266,727,000	17,621,000	14.7	258,274,000	60.2	155,497,000
1901	30,240,000	15.2	458,835,000	66.1	303,227,000	19,656,000	14.7	289,626,000	56.7	164,133,000
1900	26,236,000	13.3	350,025,000	63.3	221,668,000	16,259,000	10.6	172,204,000	59.1	101,847,000
1899	25,358,000	11.5	291,706,000	63.0	183,767,000	19,235,000	13.3	255,598,000	53.1	135,778,000
1898	25,745,000	14.9	382,492,000	62.2	237,736,000	18,310,000	16.0	292,657,000	53.0	155,034,000
1897	22,926,000	14.1	323,616,000	85.1	275,323,000	16,539,000	12.5	206,533,000	74.2	153,224,000
1896	22,794,000	11.8	267,934,000	77.0	206,270,000	11,825,000	13.5	159,750,000	65.3	104,328,000
1895	22,609,000	11.6	261,242,000	57.8	150,944,000	11,438,000	18.0	205,861,000	42.3	86,995,000
1894	23,519,000	14.0	329,290,000	49.8	164,022,000	11,364,000	11.5	130,977,000	47.2	61,880,000
1893	23,118,000	12.0	278,469,000	56.3	156,720,000	11,511,000	10.2	117,662,000	48.0	56,451,000
1892	26,209,000	13.7	359,416,000	65.1	234,037,000	12,345,000	12.7	156,531,000	56.3	88,075,000
1891	27,524,000	14.7	405,116,000	88.0	356,415,000	12,393,000	16.7	206,665,000	76.0	157,058,000
1890	23,520,000	10.9	255,374,000	87.5	223,362,000	12,567,000	11.4	143,890,000	77.4	111,411,000

WHEAT—Continued.

Acreage, production, value, and distribution of wheat in the United States in 1910, by States.

[Quantity expressed in bushels, 000 omitted.]

State, Territory, or Division.	Crop of 1910.			Farm reserves of preceding year's growth July 1—			Farm reserves March 1—			Shipped out of county where grown.		
	Acreage.	Production.	Farm value Dec. 1.	1910.		10-year average.	1911.		10-year average.	1911.		10-year average.
	Acres.	*Bush.*	*Dollars.*	*Bush.*	*P.c.*	*P.c.*	*Bush.*	*P.c.*	*P.c.*	*Bush.*	*P.c.*	*P.c.*
Maine	9,000	267	272,000	18	8.0	12.3	99	37	35	3	1	0
Vermont	1,000	29	30,000	0	1.5	4.2	10	33	37	0	0	0
New York	444,000	10,523	10,102,000	547	6.2	6.2	3,157	30	27	3,150	30	20
New Jersey	111,000	2,053	2,012,000	124	6.3	6.0	595	29	25	620	31	22
Pennsylvania	1,556,000	27,697	25,481,000	1,576	6.0	8.1	11,079	40	35	9,695	35	26
N. Atlantic	2,121,000	40,569	37,897,000	2,265	6.1	7.6	14,940	36.8	32.7	13,468	33.3	24.3
Delaware	122,000	2,074	1,867,000	66	4.0	2.8	581	28	24	1,218	58	54
Maryland	794,000	13,816	12,711,000	447	4.0	3.9	4,007	29	21	8,142	59	61
Virginia	795,000	10,176	9,871,000	354	4.0	4.7	3,460	34	26	3,060	30	34
West Virginia	410,000	5,125	5,228,000	265	5.5	7.9	1,538	30	28	816	16	15
North Carolina	652,000	7,433	8,176,000	200	3.7	5.6	2,379	32	28	444	6	6
South Carolina	453,000	4,983	6,279,000	103	2.7	3.3	1,296	26	19	50	1	2
Georgia	260,000	2,730	3,549,000	49	2.0	3.4	682	25	22	81	3	4
S. Atlantic	3,486,000	46,337	47,681,000	1,484	3.9	4.7	13,943	30.1	24.0	13,811	29.8	32.9
Ohio	1,944,000	31,493	28,344,000	2,047	8.7	8.7	10,078	32	28	15,435	49	42
Indiana	2,627,000	40,981	35,653,000	1,822	5.5	6.0	10,245	25	22	21,730	53	47
Illinois	2,100,000	31,500	27,720,000	1,197	3.8	3.9	6,615	21	20	18,900	60	44
Michigan	869,000	15,642	13,921,000	918	6.3	6.3	5,162	33	26	7,800	50	39
Wisconsin	191,000	3,659	3,366,000	219	6.3	8.1	1,244	34	33	828	23	17
N. C. E. Miss. R.	7,731,000	123,275	109,004,000	6,203	5.8	6.3	33,344	27.0	23.9	64,693	52.5	43.1
Minnesota	5,880,000	94,080	88,435,000	5,551	5.9	8.2	28,224	30	27	61,165	65	67
Iowa	530,000	11,131	9,462,000	484	6.5	5.6	4,007	36	30	5,772	52	33
Missouri	1,821,000	25,130	21,863,000	1,657	5.8	5.1	5,529	22	21	11,546	46	44
North Dakota	7,221,000	36,105	32,494,000	3,994	4.4	4.0	10,832	30	21	18,050	50	79
South Dakota	3,650,000	46,720	41,581,000	2,808	5.9	6.5	11,680	25	25	32,690	70	75
Nebraska	2,450,000	39,515	31,612,000	3,426	6.9	7.1	13,040	33	28	27,255	69	64
Kansas	4,420,000	62,068	52,137,000	3,924	4.5	5.6	12,414	20	20	40,986	66	72
N. C. W. Miss. R.	25,972,000	314,749	277,584,000	21,844	5.4	5.9	85,726	27.2	23.5	197,464	62.7	68.4
Kentucky	750,000	9,600	8,928,000	277	3.5	5.4	1,824	19	20	3,072	32	31
Tennessee	910,000	10,647	10,434,000	250	3.0	4.7	2,449	23	21	3,392	32	30
Alabama	130,000	1,560	1,763,000	31	3.0	2.8	250	16	18	64	4	3
Mississippi	5,000	70	81,000	0	1.5	1.2	21	30	11	1	1	0
Texas	1,252,000	18,780	18,404,000	101	2.0	3.4	2,629	14	12	7,896	42	24
Oklahoma	1,556,000	25,363	22,066,000	282	1.8	4.4	4,058	16	16	15,748	62	60
Arkansas	195,000	2,710	2,547,000	69	4.0	5.4	813	30	23	324	12	7
S. Central	4,798,000	68,730	64,223,000	1,010	2.5	4.4	12,044	17.5	17.0	30,497	44.3	38.2
Montana	480,000	10,560	9,081,000	431	4.0	6.9	3,062	29	29	4,770	45	30
Wyoming	107,000	2,675	2,542,000	119	5.2	4.8	802	30	29	405	15	5
Colorado	393,000	8,721	7,151,000	732	6.8	6.7	2,616	30	23	4,350	50	51
New Mexico	43,000	860	860,000	20	2.0	4.5	129	15	21	108	12	5
Arizona	17,000	379	455,000	20	5.0	2.3	53	14	15	80	20	8
Utah	255,000	5,708	4,795,000	560	9.2	8.5	1,884	33	34	2,052	36	34
Nevada	40,000	1,160	1,264,000	103	10.0	5.0	348	30	21	168	14	11
Idaho	562,000	12,603	9,074,000	825	5.7	5.0	2,773	22	22	8,442	67	62
Washington	1,486,000	25,603	19,970,000	1,753	4.9	4.2	3,840	15	16	18,432	72	77
Oregon	764,000	16,414	13,788,000	966	5.9	5.0	2,134	13	16	8,856	54	58
California	950,000	17,100	16,074,000	404	3.5	5.0	2,052	12	12	11,115	65	64
Far Western	5,097,000	101,783	85,054,000	5,933	5.4	5.2	19,693	19.3	17.6	58,778	57.8	60.5
United States	49,205,000	695,443	621,443,000	38,739	5.3	6.0	179,690	25.8	23.3	378,711	54.5	57.0

WHEAT—Continued.

Condition of the wheat crop in the United States on the first of months named, 1888–1911.

Year.	Winter wheat.						Spring wheat.			
	December of previous year.	April.	May.	June.	July.	When harvested.[a]	June.	July.	August.	When harvested.
	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.
1888	95.9	82.0	73.1	73.3	75.6	77.3	92.8	95.9	87.3	....
1889	96.8	94.0	96.0	93.1	92.0	87.5	94.4	83.3	81.2	....
1890	95.3	81.0	80.0	78.1	76.2	75.5	91.3	94.4	83.2	....
1891	98.4	96.9	97.9	96.6	96.2	96.9	92.6	94.1	95.5	....
1892	85.3	81.2	84.0	88.3	89.6	85.3	92.3	90.9	87.3	....
1893	87.4	77.4	75.4	75.5	77.7	74.0	86.4	74.1	67.0	....
1894	91.5	86.7	81.4	83.2	83.9	83.7	88.0	68.4	67.1	....
1895	89.0	81.4	82.9	71.1	65.8	75.4	97.8	102.2	95.9	....
1896	81.4	77.1	82.7	77.9	75.6	74.6	99.9	93.3	78.9	....
1897	99.5	81.4	80.2	78.5	81.2	85.7	89.6	91.2	86.7	....
1898	....	86.7	86.5	90.8	85.7	86.7	100.9	95.0	96.5	....
1899	92.6	77.9	76.2	67.3	65.6	70.9	91.4	91.7	83.6	....
1900	97.1	82.1	88.9	82.7	80.8	69.6	87.3	55.2	56.4	....
1901	97.1	91.7	94.1	87.8	88.3	82.8	92.0	95.6	80.3	....
1902	86.7	78.7	76.4	76.1	77.0	80.0	95.4	92.4	89.7	....
1903	99.7	97.3	92.6	82.2	78.8	74.7	95.9	82.5	77.1	....
1904	86.6	76.5	76.5	77.7	78.7	....	93.4	93.7	87.5	66.2
1905	82.9	91.6	92.5	85.5	82.7	....	93.7	91.0	89.2	87.3
1906	94.1	89.1	90.9	82.7	85.6	....	93.4	91.4	86.9	83.4
1907	94.1	89.9	82.9	77.4	78.3	....	88.7	87.2	79.4	77.1
1908	91.1	91.3	89.0	86.0	80.6	....	95.0	89.4	80.7	77.6
1909	85.3	82.2	83.5	80.7	82.4	....	95.2	92.7	91.6	88.6
1910	95.8	80.8	82.1	80.0	81.5	....	92.8	61.6	61.0	63.1
1911	82.5	83.3	....	....	....	....	....	....	....	....

[a] Includes both winter and spring.

Average yield of wheat in countries named, bushels per acre, 1890–1909.

Year.	United States.	Russia, European.[a]	Germany.[a]	Austria.[a]	Hungary proper.[a]	France.[b]	United Kingdom.[b]
Average (1890–1899)	13.2	8.9	24.5	16.2	....	18.6	31.2
1900	12.3	8.3	27.9	15.5	17.3	19.2	29.5
1901	15.0	8.1	23.5	16.7	15.1	18.5	31.9
1902	14.5	11.1	30.3	19.0	20.7	20.2	33.9
1903	12.9	10.6	29.2	17.8	19.0	22.8	31.1
1904	12.5	11.5	29.5	19.5	16.3	18.5	27.8
1905	14.5	10.0	28.5	19.6	18.7	20.9	33.9
1906	15.5	7.7	30.3	20.3	22.5	20.2	34.8
1907	14.0	8.0	29.6	18.0	14.9	23.2	35.1
1908	14.0	8.8	29.7	21.0	17.5	19.6	33.4
1909	15.8	12.5	30.5	19.9	14.1	21.9	35.0
Average (1900–1909)	14.1	9.7	28.9	18.0	17.5	20.5	33.1

[a] Bushels of 60 pounds. [b] Winchester bushels.

Per cent of winter wheat area sown which was abandoned (not harvested).

Year.	Per cent.	Year.	Per cent.	Year.	Per cent.
1899	13.5	1903	2.8	1907	11.2
1900	11.8	1904	15.4	1908	4.2
1901	6.7	1905	4.6	1909	7.2
1902	15.2	1906	5.5	1910	13.3

WHEAT—Continued.

Average yield per acre of wheat in the United States.

State, Territory, or Division.	10-year averages.				1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	1909.	1910.
	1866–1875.	1876–1885.	1886–1895.	1896–1905.										
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*
Maine	13.2	13.7	15.8	22.1	23.9	25.3	25.5	23.3	23.0	24.8	26.2	23.5	25.5	29.7
Vermont	17.0	16.8	18.8	21.2	18.7	18.8	20.9	25.1	18.8	22.3	23.0	23.0	25.0	29.3
New York	14.1	15.5	15.4	17.5	13.1	16.8	17.8	11.3	21.0	20.0	17.3	17.5	21.0	23.7
New Jersey	14.6	13.3	13.4	16.1	16.8	16.0	14.0	13.3	16.4	18.3	18.5	17.3	17.9	18.5
Pennsylvania	13.3	13.4	13.6	15.8	17.1	15.8	15.6	14.1	17.1	17.7	18.6	18.5	17.0	17.8
North Atlantic	13.7	14.1	14.1	16.3	16.1	16.1	16.1	13.5	17.9	18.2	18.4	18.3	17.9	19.1
Delaware	10.9	12.5	12.1	16.0	18.5	16.5	10.2	14.9	13.8	16.0	20.5	15.0	14.0	17.0
Maryland	10.6	12.8	13.3	15.9	17.2	14.7	12.5	13.4	16.3	16.0	19.0	16.4	14.5	17.4
Virginia	8.3	8.3	8.8	10.3	10.9	5.7	8.7	10.2	11.4	12.5	12.5	11.4	11.2	12.8
West Virginia	10.3	10.8	10.3	10.8	10.9	7.7	10.2	10.1	12.3	12.7	12.2	13.0	13.0	12.5
North Carolina	7.2	6.6	6.2	7.5	8.7	5.3	5.1	8.6	6.7	9.1	9.5	10.0	9.5	11.4
South Carolina	6.0	6.6	5.7	7.7	8.8	5.6	6.5	8.1	6.1	9.3	8.5	9.0	10.0	11.0
Georgia	6.9	6.9	6.1	7.9	8.2	6.0	6.2	8.8	6.9	10.0	9.0	9.2	10.0	10.5
South Atlantic	8.9	8.9	9.0	10.6	11.6	8.6	8.8	10.5	11.0	12.4	14.3	12.3	11.8	13.3
Ohio	12.0	14.6	14.4	13.8	15.3	17.1	13.7	11.5	17.1	20.4	16.3	16.0	15.9	16.2
Indiana	11.0	13.9	13.9	12.2	15.8	16.0	10.0	9.2	18.3	20.7	14.4	16.6	15.3	15.6
Illinois	11.9	13.1	14.3	13.0	17.6	17.9	8.4	13.8	16.0	19.5	18.0	13.0	17.4	15.0
Michigan	13.4	16.1	14.8	13.8	11.1	17.7	15.5	9.8	18.5	13.1	14.5	18.0	18.8	18.0
Wisconsin	13.7	12.2	13.0	15.7	16.1	18.1	15.6	15.5	16.6	16.3	14.1	18.2	19.5	19.2
N.Central E.of Miss.R	12.3	13.9	14.2	13.3	15.3	17.1	11.6	11.7	17.3	19.1	15.8	15.6	16.6	15.9
Minnesota	15.0	12.8	13.7	13.3	12.9	13.9	13.1	12.8	13.3	10.9	13.0	12.8	16.8	16.0
Iowa	12.6	10.2	12.9	14.1	16.2	12.7	12.4	11.6	14.2	15.7	13.4	17.2	17.0	21.0
Missouri	12.8	11.4	12.8	12.2	15.9	19.9	8.7	11.7	12.4	14.8	13.2	10.0	14.7	13.8
North Dakota	.....	.....	14.5	12.2	13.1	15.9	12.7	11.8	14.0	13.0	10.0	11.6	13.7	5.0
South Dakota	.....	.....	11.0	11.1	12.9	12.2	13.8	9.6	13.7	13.4	11.2	12.8	14.1	12.8
Nebraska	14.8	11.9	10.8	15.4	17.1	20.9	15.7	13.6	19.4	22.0	18.1	17.2	18.8	16.1
Kansas	15.7	13.9	12.8	13.7	18.5	10.4	14.1	12.4	13.9	15.1	11.0	12.6	14.4	14.0
N.Central W.of Miss.R	13.1	11.9	13.0	13.0	14.9	14.7	13.2	12.0	14.2	14.2	12.2	12.7	15.2	12.1
Kentucky	9.2	9.7	11.2	11.2	12.1	9.3	8.4	11.4	11.3	14.1	12.0	11.6	11.8	12.8
Tennessee	7.7	6.6	8.3	9.5	10.8	7.2	7.1	11.5	7.2	12.5	9.5	10.0	10.4	11.7
Alabama	7.6	6.4	6.9	9.1	8.7	6.0	9.1	10.3	9.6	11.0	10.0	11.5	10.5	12.0
Mississippi	9.2	6.2	6.9	9.4	8.8	8.0	8.0	8.8	10.8	10.0	11.0	14.5	11.0	14.0
Texas	12.8	10.8	10.4	12.3	8.9	9.0	13.4	10.7	8.9	11.5	7.4	11.0	9.1	15.0
Oklahoma	.....	.....	11.4	14.1	15.8	11.3	14.5	12.1	8.5	13.7	9.0	11.6	12.8	16.3
Arkansas	10.3	7.1	8.6	9.1	8.8	9.1	7.0	10.1	7.9	10.8	9.5	10.0	11.4	13.9
South Central	8.6	8.2	9.7	11.5	12.1	9.3	11.4	11.4	8.8	12.8	9.7	11.1	11.3	14.3
Montana	.....	17.7	19.8	26.9	26.5	26.0	28.2	23.9	23.8	24.0	28.8	24.2	30.8	22.0
Wyoming	.....	17.0	20.1	22.6	24.5	23.5	20.9	22.1	25.4	28.7	28.5	25.4	28.7	25.0
Colorado	.....	19.1	19.2	23.1	24.1	18.0	26.6	22.8	25.0	32.5	29.0	21.0	29.5	22.2
New Mexico	.....	13.6	14.7	19.6	21.5	17.1	18.4	12.8	22.2	25.0	24.0	25.0	24.5	20.0
Arizona	.....	13.9	15.2	21.6	21.8	18.7	25.3	25.5	22.4	25.2	25.9	26.7	25.0	22.3
Utah	.....	18.0	17.6	23.4	20.5	21.2	22.6	26.6	26.4	27.4	28.8	26.5	25.9	22.4
Nevada	21.6	18.1	17.4	25.9	25.1	27.1	27.6	26.2	27.0	31.5	32.0	30.0	28.7	29.0
Idaho	.....	17.2	18.4	23.8	21.2	22.1	21.1	22.9	28.2	24.4	25.3	28.2	27.8	22.4
Washington	.....	16.3	17.6	23.0	29.1	22.2	20.3	22.2	24.6	20.8	26.0	18.8	23.2	17.2
Oregon	18.9	17.5	16.7	18.4	21.1	20.0	18.2	19.0	18.6	20.0	23.4	20.8	20.2	21.5
California	14.8	13.0	12.4	11.3	13.0	10.9	11.2	10.8	9.3	17.1	15.0	14.6	14.0	18.0
Far Western	15.4	14.3	13.9	16.8	19.2	16.8	16.9	18.1	18.2	20.8	22.6	20.2	22.9	20.0
United States	11.9	12.3	12.7	13.5	15.0	14.5	12.9	12.5	14.5	15.5	14.0	14.0	15.8	14.1

WHEAT—Continued.

Average farm value per acre of wheat in the United States December 1.

State, Territory, or Division.	10-year averages.				1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	1909.	1910.
	1866–1875.	1876–1885.	1886–1895.	1896–1905.										
	Dolls.	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*
Maine	22.04	19.32	16.43	21.22	23.18	23.28	24.99	24.23	24.38	25.05	26.50	24.50	28.11	30.22
Vermont	26.18	21.34	18.05	20.14	17.58	20.49	19.85	28.36	16.92	19.18	23.00	23.00	30.00	30.00
New York	20.02	17.67	13.24	14.70	10.74	13.27	14.42	12.32	18.06	16.40	17.13	17.32	23.31	22.75
New Jersey	21.32	15.56	11.52	13.36	12.10	12.16	11.48	14.63	14.43	14.64	18.13	17.47	19.51	18.13
Pennsylvania	18.09	14.87	11.15	12.64	12.31	11.53	12.32	15.23	14.88	13.45	17.86	18.32	18.53	16.38
N. Atlantic	19.10	15.98	11.76	13.28	11.95	12.00	12.82	14.60	15.59	14.17	17.76	18.14	19.59	17.87
Delaware	15.37	14.25	9.68	12.80	13.13	12.38	7.96	16.09	11.32	11.36	19.88	15.00	14.56	15.30
Maryland	14.84	14.34	10.77	12.72	12.21	10.58	9.88	14.20	13.37	11.36	18.24	16.07	15.95	16.01
Virginia	10.87	8.80	7.04	8.34	7.96	4.50	7.31	11.12	10.03	10.12	12.25	11.51	12.88	12.42
W. Virginia	12.67	11.02	8.24	8.96	8.39	6.31	8.67	11.01	10.95	10.29	12.20	13.39	14.69	12.75
N. Carolina	9.79	7.39	5.46	6.82	7.13	4.88	4.95	10.23	6.83	8.46	10.16	10.70	12.06	12.54
S. Carolina	10.68	8.98	5.70	8.01	8.62	5.71	6.56	10.21	6.77	10.23	10.20	11.70	14.60	13.86
Georgia	10.49	8.56	5.92	7.90	7.71	5.88	5.95	11.09	7.38	10.20	10.35	11.13	14.50	13.65
S. Atlantic	12.09	9.90	7.44	8.91	8.93	6.86	7.49	11.82	9.86	10.22	13.93	12.84	14.06	13.68
Ohio	14.40	14.89	10.66	10.76	10.86	12.14	10.96	12.65	14.02	14.48	15.00	15.84	17.61	14.58
Indiana	12.21	13.34	9.73	9.39	11.06	10.88	7.80	9.75	15.01	14.49	12.67	16.27	16.83	13.57
Illinois	11.66	11.92	9.87	9.62	12.14	10.56	6.30	13.94	12.96	13.46	15.66	12.61	18.10	13.20
Michigan	16.21	15.94	10.95	10.63	7.88	12.21	11.94	10.58	14.61	9.43	13.19	17.46	21.06	16.02
Wisconsin	12.06	10.86	8.84	11.15	10.48	11.61	11.22	15.18	12.65	11.73	12.95	16.73	18.69	17.62
N. Central E.Miss.R.	13.11	13.32	10.11	10.17	10.70	11.38	9.00	12.27	14.00	13.44	13.94	15.21	17.93	14.10
Minnesota	11.10	10.11	8.77	8.78	7.74	8.48	9.04	11.14	9.44	7.08	11.96	12.03	16.13	15.04
Iowa	9.32	7.85	8.26	9.02	9.75	6.96	7.69	10.48	10.08	10.07	11.03	15.17	15.77	17.85
Missouri	13.18	9.92	8.19	8.66	10.97	11.54	6.18	11.23	9.80	9.92	11.09	9.30	15.43	12.01
North Dakota	......	......	7.10	7.56	7.07	9.22	8.00	9.56	9.66	8.19	8.70	10.67	12.60	4.50
South Dakota	......	......	5.50	6.77	6.84	6.95	8.56	7.58	9.18	8.17	9.97	11.78	12.69	11.39
Nebraska	10.0[illegible]	8.21	6.05	9.09	9.23	10.23	8.47	11.83	12.81	12.54	14.31	14.47	16.74	12.90
Kansas	15.39	10.29	7.68	8.63	10.92	5.73	8.33	11.06	9.88	8.75	9.03	11.06	13.85	11.80
N. Central W.Miss.R.	10.34	9.33	7.70	8.29	8.63	8.34	8.23	10.38	9.94	8.69	10.44	11.47	14.30	10.69
Kentucky	10.58	9.22	8.18	8.74	8.71	6.88	6.80	12.43	9.83	10.29	11.04	11.37	13.10	11.90
Tennessee	9.01	6.40	6.22	7.88	7.99	5.47	5.96	12.77	6.55	9.75	9.02	9.90	11.96	11.47
Alabama	10.41	7.49	6.69	8.64	7.66	5.58	8.65	11.85	9.70	10.34	10.51	12.29	13.65	13.56
Mississippi	13.98	7.87	6.42	8.37	7.57	6.80	7.44	8.89	10.26	8.70	9.50	14.00	13.00	16.20
Texas	17.66	11.12	8.11	9.84	6.94	6.93	10.45	11.77	7.83	8.85	7.33	10.78	10.74	14.70
Oklahoma	......	......	5.70	9.31	10.07	6.60	9.24	11.35	5.98	7.66	7.47	10.21	12.93	14.18
Arkansas	13.49	7.24	6.79	6.92	6.86	6.10	5.46	10.20	7.11	8.10	9.03	9.50	12.54	13.06
S. Central	10.29	8.08	7.28	8.68	8.52	6.45	8.36	11.83	7.29	8.87	8.86	10.53	12.40	13.39
Montana	......	16.99	14.45	18.02	17.76	16.12	18.61	21.28	16.90	15.36	23.33	20.82	26.75	18.92
Wyoming	......	15.81	13.67	16.50	16.91	19.04	15.47	19.89	18.29	20.95	21.93	21.56	28.42	23.76
Colorado	......	17.76	13.25	15.48	16.15	13.50	17.56	22.75	17.50	21.13	22.62	18.48	27.41	18.20
New Mexico	......	15.23	12.05	14.90	15.48	14.71	13.80	13.57	19.98	20.75	22.33	23.51	28.66	20.00
Arizona	......	14.46	12.31	19.44	18.53	19.64	23.53	28.82	26.21	25.96	27.20	32.00	34.75	26.76
Utah	......	14.76	11.44	15.91	14.35	16.11	18.08	22.88	17.69	17.81	21.31	22.51	23.32	18.80
Nevada	34.99	19.37	13.40	22.02	22.09	25.56	27.32	24.10	20.79	26.77	33.27	33.91	29.83	31.60
Idaho	......	16.17	12.70	14.99	12.93	15.44	15.86	18.34	18.49	14.66	16.92	20.83	24.20	16.15
Washington	......	12.22	10.91	14.26	13.67	14.44	14.04	17.77	16.13	12.91	19.48	15.40	21.61	13.44
Oregon	16.25	14.52	11.02	12.14	11.37	13.37	13.98	15.37	12.68	13.26	18.29	17.48	18.80	18.05
California	16.72	13.00	8.80	8.59	7.80	8.72	9.74	9.50	7.63	12.82	14.70	14.89	15.54	16.92
Far Western	16.99	13.63	9.62	11.66	10.83	12.03	12.92	15.10	12.82	14.06	18.19	17.31	21.55	16.69
United States	12.92	11.39	8.67	9.37	9.37	9.14	8.96	11.58	10.83	10.37	12.26	12.97	15.62	12.63

WHEAT—Continued.

Average farm price of wheat per bushel in the United States.

State, Territory, or Division.	Price December 1, by decades.				Price December 1, by years.									Price bimonthly, 1910.					
	1866–1875.	1876–1885.	1886–1895.	1896–1905.	1901	1902	1903	1904	1905	1906	1907	1908	1909	Feb. 1.	Apr. 1.	June 1.	Aug. 1.	Oct. 1.	Dec. 1.
	Cts.	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*
Me.	167	141	104	96	97	92	98	104	106	101	101	104	110	108	115	.....	112	113	102
Vt.	154	127	96	95	94	109	95	113	90	86	100	99	120	110	125	122	117	105	103
N. Y.	142	114	86	84	82	79	81	109	86	82	99	99	111	115	116	109	105	101	96
N. J.	146	117	86	83	72	76	82	110	88	80	98	101	109	116	113	111	107	105	98
Pa.	136	111	82	80	72	73	79	108	87	76	96	99	109	116	118	104	101	98	92
N. Atlantic.	139.4	113.3	83.4	81.5	74.2	74.7	79.8	108.3	86.9	77.7	96.7	99.1	109.5	115.8	117.2	105.6	102.3	99.1	93.4
Del.	141	114	80	80	71	75	78	108	82	71	97	100	104	114	110	93	92	95	90
Md.	140	112	81	80	71	72	79	106	82	71	96	98	110	117	115	104	98	98	92
Va.	131	106	80	81	73	79	84	109	88	81	98	101	115	119	119	111	102	101	97
W. Va.	123	102	80	83	77	82	85	109	89	81	100	103	113	116	118	116	112	109	102
N. C.	136	112	88	91	82	92	97	119	102	93	107	107	127	129	130	123	112	112	110
S. C.	178	136	100	104	98	102	101	126	111	110	120	130	146	134	133	129	124	120	126
Ga.	152	124	97	100	94	98	96	126	107	102	115	121	145	143	138	132	128	128	130
S. Atlantic.	135.8	111.2	82.7	84.1	77.1	80.2	85.4	112.1	89.6	82.7	97.2	104.4	119.5	121.9	121.2	113.3	106.6	105.7	102.9
Ohio	120	102	74	78	71	71	80	110	82	71	92	99	112	117	113	103	99	94	90
Ind.	111	96	70	77	70	68	78	106	82	70	88	98	110	117	111	100	97	92	87
Ill.	98	91	69	74	69	59	75	101	81	69	87	97	104	111	109	100	98	92	88
Mich.	121	99	74	77	71	69	77	108	79	72	91	97	112	116	111	103	99	93	89
Wis.	88	89	68	71	65	64	72	98	76	72	92	92	96	105	105	101	104	98	92
N. C. E. of Miss. River	106.6	95.8	71.2	76.5	69.8	66.5	77.4	104.7	80.9	70.3	88.1	97.7	108.2	114.8	110.7	101.1	98.2	92.8	88.4
Minn.	74	79	64	66	60	61	69	87	71	65	92	94	96	103	104	97	110	101	94
Iowa	74	77	64	64	60	55	62	90	71	64	82	88	93	97	97	93	97	92	85
Mo.	103	87	64	71	69	58	71	96	79	67	84	93	105	111	109	101	95	91	87
N. Dak.	.....	.....	49	62	54	58	63	81	69	63	87	92	92	100	100	94	109	98	90
S. Dak.	.....	.....	50	61	53	57	62	79	67	61	89	92	90	97	97	91	100	95	89
Nebr.	68	69	56	59	54	49	54	87	66	57	79	84	89	93	93	88	88	85	80
Kans.	98	74	60	63	59	55	59	89	71	58	82	88	96	101	100	96	91	89	84
N. C. W. of Miss. River	78.9	78.4	59.2	63.8	57.9	56.7	62.4	86.4	70.0	61.4	85.6	90.3	94.1	100.4	100.3	94.5	100.5	94.2	88.2
Ky.	115	95	73	78	72	74	81	109	87	73	92	98	111	116	115	108	101	98	93
Tenn.	117	97	75	83	74	76	84	111	91	78	95	99	115	121	122	114	104	101	98
Ala.	137	117	97	95	88	93	95	115	101	94	105	107	130	125	127	112	114	122	113
Miss.	152	127	93	89	86	85	93	101	95	87	88	103	121	.....	110	.....	115	110	116
Tex.	138	103	78	80	78	77	78	110	88	77	99	98	118	118	119	115	100	102	98
Okla.	.....	.....	50	66	64	59	64	94	70	56	83	88	101	104	106	101	90	89	87
Ark.	131	102	79	76	78	67	78	101	90	75	95	95	110	112	109	111	102	98	94
S. Cen.	119.7	98.5	75.0	75.5	70.4	69.2	73.3	103.9	82.8	69.2	91.3	94.9	109.2	112.5	113.3	107.5	100.0	96.1	93.4
Mont.	.....	96	73	67	67	62	66	89	71	64	81	86	87	88	94	97	102	96	86
Wyo.	.....	93	68	73	69	81	74	90	72	73	77	85	99	101	100	105	117	109	95
Colo.	.....	93	69	67	67	75	66	91	70	65	78	88	93	99	97	96	94	86	82
N. Mex.	.....	112	82	76	72	86	75	106	90	83	93	94	117	128	117	96	104	107	100
Ariz.	.....	104	81	90	85	105	93	113	117	103	105	120	139	140	140	135	95	125	120
Utah.	.....	82	65	68	70	76	80	86	67	65	74	85	90	101	110	100	97	87	84
Nev.	162	107	77	85	88	98	99	92	77	85	104	113	104	120	150	125	120	100	109
Idaho.	.....	94	69	63	61	70	75	80	66	60	67	74	87	93	91	90	77	77	72
Wash.	.....	75	62	62	47	65	69	80	66	62	75	82	93	101	102	90	85	82	78
Oreg.	86	83	66	66	54	67	77	81	68	66	78	84	93	101	100	90	90	85	84
Cal.	113	100	71	76	60	80	87	88	82	75	98	102	111	113	112	104	95	93	94
Far West.	110.3	95.3	69.2	69.4	56.4	71.7	76.4	83.6	70.3	67.4	80.6	85.7	94.0	100.2	101.1	94.0	90.1	86.0	83.6
U. S.	108.6	92.6	68.3	69.4	62.4	63.0	69.5	92.4	74.8	66.7	87.4	92.8	99.0	105.0	104.5	97.6	98.9	93.7	89.4

WHEAT—Continued.

Wholesale prices of wheat per bushel, 1897–1910.

Date.	New York.		Baltimore.		Chicago.		Detroit.		St. Louis.		Minneapolis.		San Francisco.	
	No. 2 red winter.		Southern, No. 2 red.		No. 1 northern spring. [a]		No. 2 red.		No. 2 red winter.		No. 1 northern. [b]		No. 1 California (per 100 lbs.).	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.
	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.		
1897	81⅝	111¼	50	107½	64⅛	109	74½	101	65½	103	65¼	107½	$1.21¼	$1.56¼
1898	68¾	193½	60	146½	62	185	65½	160	64	127	55	155	1.08¾	1.80¾
1899	72⅛	87½	68½	81½	64	79½	67½	80¼	68	81⅝	60	73⅞	.96¼	1.18½
1900	72⅞	96⅞	70	90	61½	87½	66¾	91½	66¼	86½	62	88⅞	.90	1.07
1901	72¾	89⅞	69¼	85¾	63⅛	79½	66½	90½	61¼	88½	60½	77½	.95	1.06¼
1902	73½	94¼	66¼	87½	67½	95	68½	93½	63	92½	66½	80⅜	1.05	1.45
1903	78¼	99⅞	76½	88¾	70¼	93	74¼	94	69¾	94	73⅛	100	1.32½	1.55
1904	92½	126¼	82	118½	81¼	122	92	123	84½	121	84¾	124½	1.23¾	1.50
1905	84⅜	125¾	73	119½	82½	124	80	124	82	120	75¼	124½	1.35	1.55
1906	77	97	68	91	71	87¼	72	93½	68⅛	99¼	69⅝	85⅜	......	......
1907.														
January	80	84	74	78½	......	......	75	78¼	74½	79¼	76¾	83⅝	1.22½	1.40
February	83	85¾	77½	81	82	87	77	79¼	76½	80	79¾	85⅛	1.25	1.35
March	80¾	85	75¾	77½	79	86½	76	78¼	75½	79	78½	81½	1.25	1.40
April	82½	91	77½	84	80	87	77¼	82½	75½	81½	79⅜	86⅛	1.27½	1.50
May	87	108⅞	84	99½	84	106	81	103	80½	101	87	105⅜	1.35	1.55
June	94⅜	104⅜	90¼	96¼	98	105	93	99¼	90½	100	96⅞	104⅜	1.42½	1.55
July	96⅝	105⅜	89½	96	100	106½	91¼	99	87½	96½	98	105¼	1.50	1.60
August	91	100⅝	85⅞	94½	93	105	83½	92¼	81	91	94¾	105⅛	1.50	1.60
September	100⅛	108¼	96⅝	104¼	105	112	92¼	99	89½	101¼	104½	111½	1.55	1.70½
October	104¾	116¼	99¾	111¼	108	122	97¾	106½	96	109½	103¼	119¾	1.60	1.77
November	94¾	108½	97¼	102½	......	......	94¼	100¼	90	99	98	107⅛	1.65	1.80½
December	104¼	109	97½	104¼	......	......	97¾	104¼	96	105	103¼	111¼	1.60	1.77
Year	80	116¼	74	111¼	79	122	75	106½	74½	109½	76¾	119¾	1.22½	1.80½
1908.														
January	100	109¼	94¾	104	......	......	95¼	105	99	106¼	105⅝	114½	1.60	1.72½
February	96⅝	104⅜	92	100½	......	......	94½	103½	96	104	101⅞	110¾	1.55	1.70
March	99¾	106¼	95½	99¾	105	108	94¾	103¾	97	106	103¼	111½	1.60	1.70
April	96⅝	109⅛	93¾	100½	105	107	92½	101½	96	102	98¾	108	1.60	1.70
May	103	111½	97½	103	......	......	97	104	100	106	106⅛	111⅞	1.63¾	1.75
June	95¾	103	89	99	107	112	89¾	97	89	101½	105⅝	110⅞	1.60	1.72½
July	96⅝	102¾	91	99	115	119	90	92½	89	93½	107¾	121	1.60	1.70
August	99⅝	105½	96	99⅝	108	124	93½	96	91½	97½	99⅞	125	1.65	1.72½
September	102¼	110¼	96⅞	104¼	105	109	96	101¾	97	106	100⅞	105⅝	1.65	1.77½
October	106¼	110⅜	101⅛	103½	102	108	100	103	100½	106½	102⅛	105	1.62½	1.75
November	109¼	114½	101¼	105⅜	104	110	102	106	101¾	109	104⅛	108⅜	1.65	1.72½
December	107⅜	115	101¼	106⅜	106½	112	102½	107	106	110	106⅛	112½	1.65	1.72½
Year	95¾	115	89	106⅜	102	124	89¾	107	89	110	98¾	125	1.55	1.77½
1909.														
January	106⅛	111¼	103¾	108¾	107	111½	104¾	108¼	107	115	107⅜	111¼	1.70	1.75
February	110⅞	126⅜	108¾	128	110½	121	108¼	125	114	130	110	116¼	1.72½	1.95
March	121⅛	128¾	122½	128½	113⅜	121½	120	130	126	138	112⅝	117⅞	1.85	2.05
April	127½	141	130	145	119	131¼	130	141	135	152½	118⅜	129¼	1.97½	2.15
May	140½	146½	145	150¾	126½	137	141	155	148	160	127⅛	135¼	2.10	2.15
June	146½	150½	152	160	129	136	143	157	128	166	128¾	138⅛	2.10	2.15
July	114½	123⅝	112	122	126½	140	107	140	105½	146	123	135	2.05	2.15
August	108	119⅛	99½	112	104½	136	105½	109	102	111	97⅝	144½	1.75	2.00
September	107⅞	114½	100	113	104	107	107	108	105	122	97¼	101⅞	1.65	1.80
October	......	......	113⅞	119¾	103	109¾	117½	127	116	129	99¼	106⅝	1.65	2.00
November	120	126	114	118	103¼	112	117¾	122½	114	127	101⅛	107¾	1.80	1.90
December	123	127½	116½	122	106	119¾	119½	126	116	132	105½	115⅛	1.95	2.00
Year	106⅛	150½	99½	160	103	140	104¾	157	102	166	97¼	144½	1.65	2.15
1910.														
January	127	131	123½	128	110½	116⅞	124	121	123	135	110⅝	116⅛	1.90	2.05
February	128	130	124	127¾	111⅜	119	123	126	124	130	110¼	116¾	1.87½	2.00
March	124½	129½	118½	125	113	118¾	116½	123	117	127½	112	116¾	1.75	1.95
April	112¼	123½	105¼	119½	108½	118¾	106	118	105	122	106½	116½	1.55	1.80
May	106½	117	104¼	109⅝	100	119¼	103	114	100	123	103	114½	1.50	1.58¾
June	104	109	94	101	100	114	104½	107	92	116	102½	117	1.40	1.50
July	107	118	92½	104	111	129½	103	110	102	114½	113	129¼	1.42½	1.70
August	106½	112⅛	97¼	106	117	125½	99½	102½	98	108	109⅜	123	1.60	1.70
September	101	108	99	104½	111	117	97	102½	97	105	109	115	1.50	1.65
October	95⅜	104	90½	98¾	103	114	93½	99	95	104	102	112½	1.42½	1.55
November	94¼	98¼	88¼	95½	101	109	91	96½	92½	99	99½	107	1.40	1.50
December	96	99½	95¼	97	104	110	94½	96¼	94	103	100⅝	106	1.45	1.52½
Year	94¼	131	88¼	128	100	129½	91	127	92	135	99½	129¼	1.40	2.05

[a] No grade, 1897 to 1901.

[b] No. 2 northern, 1897 to 1900.

WHEAT—Continued.

Average farm price of wheat per bushel, on the first of each month, 1909–1910.

Month.	United States.		North Atlantic States.		South Atlantic States.		N. Cen. States East of Miss. R.		N. Cen. States West of Miss. R.		South Central States.		Far Western States.	
	1910.	1909.	1910.	1909.	1910.	1909.	1910.	1909.	1910.	1909.	1910.	1909.	1910.	1909.
	Cts.	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*
January	103.4	93.5	113.1	99.1	120.9	103.8	112.8	97.2	98.5	91.5	112.2	96.5	100.0	86.7
February	105.0	95.2	115.8	100.1	121.9	105.3	114.8	99.3	100.4	92.7	112.5	97.7	100.2	90.8
March	105.1	103.9	117.6	109.5	122.8	114.4	114.0	111.3	100.1	99.9	113.8	103.3	101.2	101.2
April	104.5	107.0	117.2	113.7	121.2	117.9	110.7	115.4	100.3	101.9	113.3	110.3	101.1	104.1
May	99.9	115.9	110.4	121.9	115.3	124.8	103.4	124.4	97.1	110.9	109.3	120.8	94.4	113.1
June	97.6	123.5	105.6	126.8	113.3	135.0	101.1	133.8	94.5	118.2	107.5	124.9	94.0	120.7
July	95.3	120.8	102.9	129.7	108.8	130.4	97.0	129.4	94.4	115.8	97.1	122.2	88.9	118.3
August	98.9	107.1	102.3	117.1	106.6	117.8	98.2	104.9	100.5	104.7	100.0	109.3	90.1	108.4
September	95.8	95.2	100.6	102.6	106.1	112.5	95.1	98.4	95.6	89.9	96.4	102.2	91.9	95.3
October	93.7	94.6	99.1	105.1	105.7	110.0	92.8	102.4	94.2	88.7	96.1	104.3	86.0	88.2
November	90.5	99.9	97.0	108.4	104.3	117.8	90.4	108.8	89.4	93.7	94.5	110.3	86.0	92.0
December	89.4	99.0	93.4	109.5	102.9	119.5	88.4	108.2	88.2	94.1	93.4	109.2	83.6	94.0

International trade in wheat, 1905–1909.[a]

EXPORTS.

Country.	Year beginning—	1905.	1906.	1907.	1908.	1909.
		Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Argentina	Jan. 1	105,391,256	82,599,397	98,502,584	133,610,896	92,377,517
Australia	Jan. 1	25,424,969	30,262,335	28,784,130	15,027,388	31,549,498
Austria-Hungary	Jan. 1	49,321	1,118,588	683,014	14,720	10,872
Belgium	Jan. 1	14,639,453	16,051,913	17,852,194	24,178,475	22,844,944
British India	Jan. 1	47,680,406	26,488,483	37,515,771	4,289,344	39,128,090
Bulgaria	Jan. 1	16,542,617	9,856,687	8,845,502	7,818,338	5,912,621
Canada	Jan. 1	28,669,571	38,135,023	37,503,057	52,502,903	49,428,195
Chile	Jan. 1	294,656	8,065	1,297,765	4,946,857	4,015,364
Germany[b]	Jan. 1	6,050,111	7,365,175	3,520,763	9,594,177	7,708,178
Netherlands	Jan. 1	53,052,451	33,126,858	44,717,615	29,914,096	47,469,644
Roumania	Jan. 1	63,066,299	63,485,127	42,307,592	26,247,406	[c]31,514,810
Russia	Jan. 1	176,852,636	132,410,638	85,270,647	54,050,456	[c]189,128,151
Servia	Jan. 1	3,422,554	3,365,644	1,992,514	3,319,526	5,296,155
United States	Jan. 1	20,738,635	62,850,984	91,383,648	92,779,509	48,489,674
Other countries		5,706,970	6,038,597	10,600,009	6,043,000	[c]9,310,000
Total		567,581,905	513,163,514	510,776,805	464,337,091	584,183,713

IMPORTS.

Country.	Year beginning—	1905.	1906.	1907.	1908.	1909.
Austria-Hungary	Jan. 1	3,974,199	1,216,790	87,535	290,334	26,976,334
Belgium	Jan. 1	64,789,991	67,928,168	67,469,371	67,032,575	70,921,646
Brazil	Jan. 1	7,873,510	8,511,259	9,070,298	9,551,436	[d]9,551,436
Denmark	Jan. 1	3,447,367	4,168,334	2,820,299	3,593,773	3,496,826
France	Jan. 1	6,713,342	11,288,433	13,131,250	2,752,415	5,248,539
Germany[b]	Jan. 1	84,054,403	73,784,363	90,200,107	76,814,333	89,400,124
Greece	Jan. 1	5,733,503	7,426,048	7,454,387	6,638,757	6,490,139
Italy	Jan. 1	43,047,890	50,473,571	34,281,799	29,026,788	48,955,825
Japan	Jan. 1	2,281,022	789,540	2,008,998	1,319,524	778,524
Netherlands	Jan. 1	61,992,589	44,506,710	53,704,405	40,159,483	59,724,417
Portugal	Jan. 1	4,672,573	3,853,239	962,467	4,604,041	3,898,434
Spain	Jan. 1	32,517,661	19,312,985	4,290,674	2,902,239	3,529,873
Sweden	Jan. 1	7,255,222	7,838,974	5,656,901	7,599,881	7,070,799
Switzerland	Jan. 1	16,158,553	16,196,009	17,211,359	12,140,012	14,699,277
United Kingdom	Jan. 1	181,579,837	172,808,565	180,443,017	168,629,046	182,219,770
Other countries		14,032,454	18,299,933	15,260,252	13,189,000	[c]7,309,000
Total		540,124,116	508,402,921	504,053,119	446,243,637	540,270,963

[a] See "General note," p. 507.
[b] Not including free ports prior to March 1, 1906.
[c] Preliminary.
[d] Year preceding.

WHEAT—Continued.

International trade in wheat flour, 1905–1909. [a]

EXPORTS.

Country.	Year beginning—	1905.	1906.	1907.	1908.	1909.
		Barrels.	*Barrels.*	*Barrels.*	*Barrels.*	*Barrels.*
Argentina	Jan. 1	1,628,271	1,450,979	1,434,118	1,276,656	1,310,241
Australia	Jan. 1	1,573,663	1,702,801	1,667,722	1,191,861	1,326,216
Austria-Hungary	Jan. 1	795,853	658,449	658,555	413,076	163,111
Belgium	Jan. 1	857,017	439,659	442,303	529,660	583,822
British India	Jan. 1	577,961	417,984	476,995	350,407	365,851
Bulgaria	Jan. 1	214,587	261,974	293,509	287,042	348,572
Canada	Jan. 1	1,278,770	1,516,170	1,858,483	1,747,163	2,541,849
Chile	Jan. 1	91,617	50,008	42,207	25,446	[b] 64,234
France	Jan. 1	336,530	344,996	299,247	365,496	493,116
Germany [c]	Jan. 1	991,701	663,437	987,604	1,702,862	1,855,560
Italy	Jan. 1	322,004	355,934	510,538	499,259	472,266
Netherlands	Jan. 1	199,777	110,985	159,970	145,451	292,223
Roumania	Jan. 1	484,511	745,296	556,898	172,470	[b] 212,673
Russia	Jan. 1	1,090,480	1,131,591	744,832	597,477	[b] 989,417
Servia	Jan. 1	21,794	86,885	33,570	62,998	53,027
United Kingdom	Jan. 1	603,710	599,560	692,366	988,326	780,172
United States	Jan. 1	11,344,432	14,324,100	15,276,506	13,013,025	9,687,993
Other countries	....	384,261	282,193	560,528	803,000	[b] 1,041,000
Total	....	22,796,939	25,143,001	26,695,951	24,171,675	22,581,343

IMPORTS.

Country.	Year beginning—	1905.	1906.	1907.	1908.	1909.
Belgium	Jan. 1	41,516	55,601	48,735	31,735	23,211
Brazil	Jan. 1	1,579,954	1,731,596	1,915,018	1,699,315	[d] 1,699,315
China	Jan. 1	633,851	1,214,069	3,002,982	1,194,514	405,971
Cuba	Jan. 1	764,024	735,950	861,865	780,514	807,220
Denmark	Jan. 1	276,489	328,972	384,268	441,515	515,921
Egypt	Jan. 1	1,365,764	1,684,257	1,582,387	1,919,766	1,916,444
Finland	Jan. 1	794,748	879,955	963,974	1,022,029	964,691
France	Jan. 1	140,854	98,572	197,245	81,824	49,118
Germany [c]	Jan. 1	240,560	242,116	221,301	190,882	141,292
Greece	Jan. 1	28,942	110,867	60,923	24,953	12,711
Italy	Jan. 1	12,513	15,043	18,605	18,021	11,864
Japan	Jan. 1	1,242,854	1,082,671	838,641	352,537	172,165
Netherlands	Jan. 1	1,863,924	2,260,321	1,908,957	2,200,426	2,085,637
Newfoundland	Jan. 1	371,407	411,781	366,237	340,876	[d] 340,876
Norway	Jan. 1	430,956	472,995	564,617	632,712	548,686
Philippine Islands	Jan. 1	176,580	231,301	266,644	231,305	296,560
Spain	Jan. 1	663,272	161,765	695	172	630
Sweden	Jan. 1	57,839	83,949	125,421	120,137	70,646
Trinidad and Tobago	April 1	207,922	237,668	226,291	230,994	226,079
United Kingdom	Jan. 1	6,779,921	8,024,846	7,565,526	7,358,072	6,282,145
Other countries	....	3,617,003	4,056,874	4,415,503	5,293,000	[b] 4,530,000
Total	....	21,290,893	24,121,169	25,535,835	24,165,299	21,101,182

[a] See "General note," p. 507.
[b] Preliminary.
[c] Not including free ports prior to March 1, 1906.
[d] Year preceding.

WHEAT—Continued.

International trade in wheat, including wheat flour, 1905–1909.[a]

EXPORTS.

Country.	Year beginning—	1905	1906	1907	1908	1909
		Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Argentina	Jan. 1	112,718,476	89,128,803	104,956,115	139,355,848	98,273,602
Australia	Jan 1	32,506,453	37,924,939	36,288,879	20,390,762	37,517,470
Austria-Hungary	Jan. 1	3,630,659	4,081,608	3,646,512	1,873,562	744,872
Belgium	Jan. 1	18,496,029	18,030,379	19,842,558	26,561,945	25,472,143
British India	Jan. 1	50,281,230	28,369,411	39,662,249	5,866,175	40,774,420
Bulgaria	Jan. 1	17,508,259	11,035,570	10,166,292	9,110,027	7,481,195
Canada	Jan. 1	34,424,036	44,957,788	45,866,231	60,365,137	60,866,515
Chile	Jan. 1	706,932	233,101	1,487,697	5,061,364	4,304,417
France	Jan. 1	1,553,389	1,639,164	1,394,463	1,863,508	2,896,235
Germany[b]	Jan. 1	10,512,765	10,350,641	7,964,981	17,257,056	16,058,198
Italy	Jan. 1	1,465,332	1,616,547	2,369,916	2,271,395	2,141,070
Netherlands	Jan. 1	53,951,447	33,626,290	45,437,480	30,568,626	48,784,648
Roumania	Jan. 1	65,246,599	66,838,959	44,813,633	27,023,521	[c]32,471,838
Russia	Jan. 1	181,759,796	137,502,798	88,622,391	56,739,102	[c]193,580,527
Servia	Jan. 1	3,520,627	3,756,626	2,143,579	3,603,017	5,534,777
United Kingdom	Jan. 1	2,803,381	2,792,173	3,600,114	5,026,976	3,950,066
United States	Jan. 1	71,788,579	127,309,434	160,127,925	151,338,121	92,085,642
Other countries		7,294,141	7,112,787	12,517,571	8,833,000	12,860,000
Total		670,168,130	626,307,018	630,908,586	573,109,142	685,797,635

IMPORTS.

Country.	Year beginning—	1905	1906	1907	1908	1909
Austria-Hungary	Jan. 1	3,974,199	1,255,868	130,321	332,931	27,162,971
Belgium	Jan. 1	64,976,813	68,178,372	67,688,679	67,175,383	71,026,095
Brazil	Jan. 1	14,983,303	16,303,441	17,687,879	17,198,354	[d]17,198,354
China	Jan. 1	2,852,330	5,463,370	13,513,419	5,375,313	1,826,870
Cuba	Jan. 1	3,438,108	3,311,775	3,878,392	3,512,313	3,632,490
Denmark	Jan. 1	4,691,567	5,648,708	4,549,505	5,580,591	5,818,470
Egypt	Jan. 1	7,247,951	8,293,376	7,701,728	9,280,247	8,797,443
Finland	Jan. 1	3,580,581	3,966,878	4,397,732	4,612,775	4,348,581
France	Jan. 1	7,347,185	11,732,007	14,018,852	3,120,623	5,469,570
Germany[b]	Jan. 1	85,136,923	74,873,885	91,195,961	77,673,302	90,035,938
Greece	Jan. 1	5,863,742	7,924,950	7,728,541	6,751,045	6,547,339
Italy	Jan. 1	43,104,199	50,541,265	34,365,521	29,107,883	49,009,213
Japan	Jan. 1	7,873,865	5,661,560	5,782,882	2,905,941	1,553,266
Netherlands	Jan. 1	70,380,247	54,678,154	62,294,711	50,061,400	69,109,783
Newfoundland	July 1	1,671,332	1,853,014	1,648,066	1,533,942	[d]1,533,942
Norway	Jan. 1	2,670,577	2,894,356	3,092,015	3,675,974	3,273,259
Philippine Islands	Jan. 1	794,672	1,040,854	1,199,898	1,040,872	1,334,520
Portugal	Jan. 1	4,672,573	3,853,239	962,467	4,604,041	3,898,434
Spain	Jan. 1	35,502,385	20,040,927	4,293,802	2,903,013	3,532,708
Sweden	Jan. 1	7,515,498	8,216,744	6,221,295	8,140,497	7,388,706
Switzerland	Jan. 1	16,158,553	16,196,009	17,211,359	12,140,012	14,699,277
Trinidad and Tobago	Apr. 1	935,649	1,069,506	1,018,310	1,039,473	1,017,356
United Kingdom	Jan. 1	212,089,481	208,920,372	214,487,884	201,740,370	210,489,422
Other countries		28,471,400	35,029,552	33,895,156	35,481,000	[c]26,520,000
Total		635,933,133	616,948,182	618,964,375	554,987,295	635,224,007

[a] "General note," p. 507.
[b] Not including free ports prior to March 1, 1906.
[c] Preliminary.
[d] Year preceding.

OATS.

Oat area of countries named, 1906–1910.

Country.	1906.	1907.	1908.	1909.	1910.
NORTH AMERICA.					
	Acres.	*Acres.*	*Acres.*	*Acres.*	*Acres.*
United States	30,958,800	31,837,000	32,344,000	33,204,000	35,288,000
Canada:					
New Brunswick	194,600	194,200	203,900	207,200	213,900
Ontario	2,716,700	2,932,500	3,108,400	3,142,200	3,272,000
Manitoba	1,156,000	1,213,600	1,322,800	1,390,000	1,451,000
Saskatchewan	639,900	801,800	930,100	1,847,000	1,973,000
Alberta	335,700	307,100	549,400	820,000	974,000
Other	(a)	1,786,900	1,826,500	1,896,200	1,980,200
Total Canada	....	7,236,100	7,941,100	9,302,600	9,864,100
Mexico	(a)	(a)	(a)	(a)	(a)
EUROPE.					
Austria-Hungary:					
Austria	4,531,100	4,783,200	4,495,600	4,574,400	4,529,400
Hungary proper	2,562,800	2,653,100	2,612,500	2,695,200	2,748,400
Croatia-Slavonia	250,900	248,700	246,800	246,900	243,400
Bosnia-Herzegovina	271,700	215,500	220,700	207,100	185,300
Total Austria-Hungary	7,616,500	7,900,500	7,575,600	7,723,600	7,706,500
Belgium	645,500	613,900	630,100	(a)	(a)
Bulgaria	468,500	468,900	562,700	485,700	481,800
Denmark	1,006,100	996,000	996,000	995,900	995,800
Finland	(a)	(a)	(a)	(a)	(a)
France	9,525,600	9,565,300	9,628,800	9,702,500	9,672,200
Germany	10,431,600	10,816,000	10,564,400	10,650,100	10,599,100
Italy	(a)	(a)	(a)	(a)	1,243,700
Netherlands	343,800	344,200	345,500	349,700	345,100
Norway	(a)	264,300	272,100	270,200	262,600
Roumania	943,700	871,000	1,211,600	1,197,200	1,103,900
Russia:					
Russia proper	38,211,800	37,964,500	37,697,900	37,603,600	....
Poland	2,779,700	2,829,100	2,794,900	2,813,900	....
Northern Caucasia	969,000	981,500	1,107,100	1,122,400	....
Total Russia (European)	41,960,500	41,775,100	41,599,900	41,539,900	42,922,900
Servia	261,500	237,500	249,500	252,000	221,000
Spain	1,192,200	1,186,500	1,210,600	1,227,200	1,255,800
Sweden	2,007,900	2,002,800	1,998,300	1,994,100	(a)
United Kingdom:					
Great Britain—					
England	1,881,100	1,967,700	1,958,700	1,839,900	1,857,700
Scotland	956,800	951,000	948,500	943,400	958,100
Wales	205,100	203,900	201,600	198,500	205,100
Ireland	1,076,300	1,075,400	1,060,300	1,035,800	1,073,700
Total United Kingdom	4,119,300	4,198,000	4,169,100	4,017,600	4,094,600
ASIA.					
Cyprus	(a)	(a)	(a)	(a)	(a)
Russia:					
Central Asia	436,700	615,900	715,900	976,400	....
Siberia	2,966,100	3,113,500	3,343,500	3,751,200	....
Transcaucasia	1,900	1,300	1,200	1,400	....
Total Russia (Asiatic)	3,404,700	3,730,700	4,060,600	4,729,000	4,427,000
AFRICA.					
Algeria	316,700	340,700	425,200	361,400	404,500
Tunis	84,000	91,400	93,900	148,300	153,200
Union of South Africa	(a)	(a)	(a)	(a)	(a)
AUSTRALASIA.					
Australia:					
Queensland	500	1,200	700	1,800	2,800
New South Wales	38,500	56,500	75,800	59,900	81,500
Victoria	312,100	380,500	398,700	419,900	384,200
South Australia	56,900	57,000	66,300	78,500	85,300
Western Australia	15,700	28,400	46,700	59,400	73,300
Tasmania	42,800	58,300	54,600	56,700	71,300
Total Australia	466,500	581,900	642,800	676,200	698,400
New Zealand	360,600	372,900	386,900	406,900	377,000
Total Australasia	827,100	954,800	1,029,700	1,083,100	1,075,400

a No official statistics of area; estimates of production on p. 524.

OATS—Continued.

Oat crop of countries named, 1906–1910.

Country.	1906.	1907.	1908.	1909.	1910.
NORTH AMERICA.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
United States	964,905,000	754,443,000	807,156,000	1,007,353,000	1,126,765,000
Canada:					
New Brunswick	6,052,000	6,107,000	5,373,000	6,136,000	6,748,000
Ontario	115,113,000	88,745,000	110,310,000	116,017,000	136,974,000
Manitoba	53,861,000	44,775,000	47,506,000	58,721,000	44,351,000
Saskatchewan	25,463,000	24,783,000	31,030,000	97,533,000	65,203,000
Alberta	13,958,000	9,826,000	24,227,000	40,775,000	25,122,000
Other	45,687,000	54,981,000	47,580,000	56,376,000	65,267,000
Total Canada	260,134,000	229,217,000	266,026,000	375,558,000	343,665,000
Mexico	17,000	17,000	17,000	17,000	17,000
Total	1,225,056,000	983,677,000	1,073,199,000	1,382,928,000	1,470,447,000
EUROPE.					
Austria-Hungary:					
Austria	154,551,000	170,605,000	144,069,000	171,940,000	142,001,000
Hungary proper	87,733,000	79,484,000	70,168,000	92,270,000	74,681,000
Croatia-Slavonia	5,541,000	4,174,000	4,253,000	5,607,000	5,445,000
Bosnia-Herzegovina	3,543,000	2,575,000	3,572,000	4,575,000	4,478,000
Total Austria-Hungary	251,368,000	256,838,000	222,062,000	274,392,000	226,605,000
Belgium	45,228,000	45,937,000	43,058,000	40,000,000	30,000,000
Bulgaria	11,884,000	7,416,000	11,252,000	9,356,000	13,193,000
Denmark	38,726,000	42,529,000	40,437,000	42,170,000	40,663,000
Finland	19,612,000	20,643,000	19,000,000	18,000,000	19,452,000
France	256,943,000	303,889,000	285,837,000	331,183,000	315,133,000
Germany	580,875,000	630,324,000	530,131,000	628,718,000	544,287,000
Italy	30,000,000	30,000,000	30,000,000	43,402,000	28,574,000
Netherlands	19,588,000	20,933,000	19,683,000	19,361,000	20,357,000
Norway	9,297,000	6,946,000	11,315,000	8,804,000	10,488,000
Roumania	26,165,000	17,842,000	17,212,000	25,945,000	29,647,000
Russia:					
Russia proper	544,933,000	729,813,000	743,523,000	960,498,000	....
Poland	66,425,000	72,574,000	66,135,000	73,758,000	....
Northern Caucasia	21,933,000	19,697,000	24,860,000	33,428,000	....
Total Russia (European)	633,291,000	822,084,000	834,518,000	1,067,684,000	966,248,000
Servia	4,642,000	2,984,000	3,057,000	3,445,000	2,205,000
Spain	28,077,000	16,998,000	28,114,000	34,307,000	29,018,000
Sweden	64,550,000	64,597,000	72,773,000	69,292,000	75,238,000
United Kingdom:					
Great Britain—					
England	84,102,000	94,606,000	82,470,000	80,573,000	81,501,000
Scotland	35,108,000	36,193,000	37,920,000	39,097,000	38,194,000
Wales	8,063,000	7,829,000	7,133,000	7,233,000	8,084,000
Ireland	53,111,000	50,850,000	54,032,000	57,467,000	65,770,000
Total United Kingdom	180,384,000	189,478,000	181,555,000	184,370,000	193,549,000
Total	2,200,630,000	2,479,438,000	2,350,004,000	2,800,429,000	2,544,657,000
ASIA.					
Cyprus	359,000	331,000	410,000	400,000	400,000
Russia:					
Central Asia	9,805,000	18,049,000	17,371,000	15,633,000	....
Siberia	69,873,000	67,114,000	89,500,000	62,033,000	....
Transcaucasia	35,000	13,000	27,000	37,000	....
Total Russia (Asiatic)	79,713,000	85,176,000	106,898,000	77,703,000	79,743,000
Total	80,072,000	85,507,000	107,308,000	78,103,000	80,143,000

OATS—Continued.

Oat crop of countries named, 1906–1910—Continued.

Country.	1906.	1907.	1908.	1909.	1910.
AFRICA.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Algeria	9,379,000	10,651,000	9,600,000	10,673,000	13,258,000
Tunis	2,411,000	3,149,000	1,736,000	5,443,000	5,374,000
Union of South Africa	3,500,000	3,500,000	3,500,000	3,500,000	3,500,000
Total	15,290,000	17,300,000	14,836,000	19,616,000	22,132,000
AUSTRALASIA.					
Australia:					
Queensland	6,000	30,000	10,000	40,000	52,000
New South Wales	911,000	1,449,000	879,000	1,154,000	2,009,000
Victoria	7,460,000	9,124,000	5,365,000	11,475,000	8,163,000
South Australia	897,000	924,000	902,000	1,320,000	1,247,000
Western Australia	293,000	472,000	745,000	765,000	1,287,000
Tasmania	1,238,000	2,042,000	1,574,000	1,900,000	2,422,000
Total Australia	10,805,000	14,041,000	9,475,000	16,654,000	15,180,000
New Zealand	13,108,000	11,555,000	15,495,000	19,503,000	13,953,000
Total Australasia	23,913,000	25,596,000	24,970,000	36,157,000	29,133,000
Grand total	3,544,961,000	3,591,518,000	3,570,317,000	4,317,233,000	4,146,512,000

Condition of the oat crop in the United States on the first of months named, 1890–1910.

Year.	June.	July.	August.	When harvested.	Year.	June.	July.	August.	When harvested.	Year.	June.	July.	August.	When harvested.
	P. ct.	*P. ct.*	*P. ct.*	*P. ct.*		*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*		*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
1890	89.8	81.6	70.1	64.4	1897	89.0	87.5	86.0	84.6	1904	89.2	89.8	86.6	85.6
1891	85.1	87.6	89.5	90.7	1898	98.0	92.8	84.2	79.0	1905	92.9	92.1	90.8	90.3
1892	88.5	87.2	86.2	78.9	1899	88.7	90.0	90.8	87.2	1906	85.9	84.0	82.8	81.9
1893	88.9	88.8	78.3	74.9	1900	91.7	85.5	85.0	82.9	1907	81.6	81.0	75.6	65.5
1894	87.0	77.7	76.5	77.8	1901	85.3	83.7	73.6	72.1	1908	92.9	85.7	76.8	69.7
1895	84.3	83.2	84.5	86.0	1902	90.6	92.1	89.4	87.2	1909	88.7	88.3	85.5	83.8
1896	98.8	96.3	77.3	74.0	1903	85.5	84.3	79.5	75.7	1910	91.0	82.2	81.5	83.3

Average yield of oats in countries named, bushels per acre, 1890–1909.

Year.	United States.	Russia, European.[a]	Germany.[a]	Austria.[a]	Hungary proper.[a]	France.[b]	United Kingdom.[b]
Average (1890–1899)	26.1	17.8	40.0	25.3	....	29.8	43.6
1900	29.6	20.0	48.0	25.2	28.9	25.7	43.5
1901	25.8	14.4	44.6	25.6	27.2	23.5	42.9
1902	34.5	21.8	50.1	27.7	33.2	29.2	48.3
1903	28.4	17.7	51.2	28.3	34.5	31.6	44.2
1904	32.1	25.7	46.2	24.3	25.6	27.2	44.2
1905	34.0	20.2	43.6	27.7	31.0	28.6	41.7
1906	31.2	15.1	55.7	34.1	34.2	27.0	43.8
1907	23.7	19.7	58.3	35.7	30.0	31.8	45.1
1908	25.0	20.1	50.2	32.0	26.8	29.6	43.5
1909	30.3	25.7	59.0	37.6	33.8	34.1	45.9
Average (1900–1909)	29.3	20.0	50.7	29.8	30.7	31.6	44.3

[a] Bushels of 32 pounds.
[b] Winchester bushels.

OATS—Continued.

Acreage, production, value, prices, exports, etc., of oats in the United States, 1849–1910.

Year.	Acreage sown and harvested.	Average yield per acre.	Production.	Average farm price per bushel Dec. 1.	Farm value Dec. 1.	Chicago cash price per bushel, No. 2. December. Low.	Chicago cash price per bushel, No. 2. December. High.	Chicago cash price per bushel, No. 2. May of following year. Low.	Chicago cash price per bushel, No. 2. May of following year. High.	Domestic exports, including oatmeal, fiscal year beginning July 1.[a]	Imports during fiscal year beginning July 1.[b]
	Acres.	*Bush.*	*Bushels.*	*Cts.*	*Dollars.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Bushels.*	*Bushels*
1849 [c]	....	.....	146,584,000	......	....	......	......	......	......	....	....
1859 [c]	....	.....	172,643,000	......	....	......	......	......	......	....	....
1866	8,864,000	30.2	268,141,000	35.1	94,058,000	36	43	59	78	825,895	778,198
1867	10,746,000	25.9	278,698,000	44.5	123,903,000	52	57¼	......	......	122,554	780,798
1868	9,666,000	26.4	254,961,000	41.7	106,356,000	43	49½	56¾	62½	481,871	326,659
1869	9,461,000	30.5	288,334,000	38.0	109,522,000	40	44¾	46½	53½	121,517	2,266,785
1870	8,792,000	28.1	247,277,000	39.0	96,444,000	37¾	41	47¼	51	147,572	599,514
1871	8,366,000	30.6	255,743,000	36.2	92,591,000	30¾	33	34¾	42½	262,975	535,250
1872	9,001,000	30.2	271,747,000	29.9	81,304,000	23½	25¾	30	34	714,072	225,555
1873	9,752,000	27.7	270,340,000	34.6	93,474,000	34	40⅝	44	48½	812,873	191,802
1874	10,897,000	22.1	240,369,000	47.1	113,134,000	51¾	54½	57¼	64½	504,770	1,500,040
1875	11,915,000	29.7	354,318,000	32.0	113,441,000	29½	30½	28⅝	31½	1,466,228	121,547
1876	13,359,000	24.0	320,884,000	32.4	103,845,000	31¾	34½	37¼	45¾	2,854,128	41,597
1877	12,826,000	31.7	406,394,000	28.4	115,546,000	24⅛	27	23	27	3,715,479	21,391
1878	13,176,000	31.4	413,579,000	24.6	101,752,000	19⅝	20⅜	24⅜	30½	5,452,136	13,395
1879	12,684,000	28.7	363,761,000	33.1	120,533,000	32¾	36¾	29½	34⅞	766,366	489,576
1880	16,188,000	25.8	417,885,000	36.0	150,244,000	29⅛	33½	36¼	39½	402,904	64,412
1881	16,832,000	24.7	416,481,000	46.4	193,199,000	43½	46¾	48¾	56⅜	625,690	1,850,983
1882	18,495,000	26.4	488,251,000	37.5	182,978,000	34¾	41½	38¾	42¾	461,496	815,017
1883	20,325,000	28.1	571,302,000	32.7	187,040,000	29⅜	36⅛	30¾	34¼	3,274,622	121,069
1884	21,301,000	27.4	583,628,000	27.7	161,528,000	22½	25¼	34½	37	6,203,104	94,310
1885	22,784,000	27.6	629,409,000	28.5	179,632,000	27	29	26¼	29⅝	7,311,306	149,480
1886	23,658,000	26.4	624,134,000	29.8	186,138,000	25¾	27¼	25⅛	27½	1,374,635	139,575
1887	25,921,000	25.4	659,618,000	30.4	200,700,000	28⅝	30⅞	32½	38	573,080	123,817
1888	26,998,000	26.0	701,735,000	27.8	195,424,000	25	26⅞	21⅝	23⅝	1,191,471	131,501
1889	27,462,000	27.4	751,515,000	22.9	171,781,000	20	21	24¾	30	15,107,238	153,232
1890	26,431,000	19.8	523,621,000	42.4	222,048,000	39⅞	43⅞	45¼	54	1,382,836	41,848
1891	25,582,000	28.9	738,394,000	31.5	232,312,000	31⅛	33⅝	28⅛	33½	10,586,644	47,782
1892	27,064,000	24.4	661,035,000	31.7	209,254,000	25⅝	31¼	28¾	32¼	2,700,793	49,433
1893	27,273,000	23.4	638,855,000	29.4	187,576,000	27½	29⅛	32½	36	6,290,229	31,759
1894	27,024,000	24.5	662,037,000	32.4	214,817,000	28¾	29⅜	27½	30¾	1,708,824	330,318
1895	27,878,000	29.6	824,444,000	19.9	163,655,000	16⅝	17½	18	19⅜	15,156,618	66,602
1896	27,566,000	25.7	707,346,000	18.7	132,485,000	16½	18¾	16⅞	18¾	37,725,083	131,204
1897	25,730,000	27.2	698,768,000	21.2	147,975,000	21	23⅞	26	32	73,880,307	25,093
1898	25,777,000	28.4	730,907,000	25.5	186,405,000	26	27¾	24	27¾	33,534,362	28,098
1899	26,341,000	30.2	796,178,000	24.9	198,168,000	22¼	23	21¼	23¾	45,048,857	54,576
1900	27,365,000	29.6	809,126,000	25.8	208,669,000	21¾	22¾	27⅞	31	42,268,931	32,107
1901	28,541,000	25.8	736,809,000	39.9	293,659,000	42	48¼	41	49½	13,277,612	38,978
1902	28,653,000	34.5	987,843,000	30.7	303,585,000	29¼	32	33⅜	38¼	8,381,805	150,065
1903	27,638,000	28.4	784,094,000	34.1	267,662,000	34¼	38	39⅝	44¾	1,960,740	183,983
1904	27,843,000	32.1	894,596,000	31.3	279,900,000	28¼	32	d 28⅝	d 32	8,394,692	55,699
1905	28,047,000	34.0	953,216,000	29.1	277,048,000	d 29½	d 32¾	d 32⅛	d 34¾	48,434,541	40,025
1906	30,959,000	31.2	964,905,000	31.7	306,293,000	d 33	d 35¾	d 44½	d 48½	6,386,334	91,289
1907	31,837,000	23.7	754,443,000	44.3	334,568,000	d 46½	d 50⅞	d 52¾	d 56½	2,518,855	383,418
1908	32,344,000	25.0	807,156,000	47.2	381,171,000	d 48⅜	d 50½	d 56¼	d 62½	2,333,817	6,691,700
1909	33,204,000	30.3	1,007,353,000	40.5	408,174,000	d 40	d 45	d 36½	d 43¼	2,548,726	1,034,511
1910	35,288,000	31.9	1,126,765,000	34.1	384,716,000	d 31	d 32½	......	......	....	....

[a] Oatmeal not included 1866 to 1882, inclusive.
[b] Oatmeal not included 1867 to 1882, inclusive, and 1909.
[c] Census figures.
[d] Quotations are for standard.

OATS—Continued.

Acreage, production, value, and distribution of oats in the United States in 1910, by States.

[Quantity expressed in bushels, 000 omitted.]

State, Territory, or Division.	Crop of 1910.			Farm reserves of preceding year's growth Aug. 1—			Farm reserves Mar. 1—			Shipped out of county where grown.		
	Acreage.	Production.	Farm value Dec. 1.	1910.		10-year average.	1911.		10-year average.	1911.		10-year average.
	Acres.	*Bush.*	*Dollars.*	*Bush.*	*P.c.*	*P.c.*	*Bush.*	*P.c.*	*P.c.*	*Bush.*	*P.c.*	*P.c.*
Maine	131,000	5,554	2,666,000	262	5.7	5.7	1,944	35	34	168	3	2
New Hampshire	14,000	599	305,000	13	3.0	3.4	210	35	29	0	0	1
Vermont	85,000	3,528	1,764,000	91	3.5	3.7	1,270	36	37	0	0	1
Massachusetts	7,000	248	124,000	5	2.3	2.8	79	32	29	10	5	0
Rhode Island	2,000	70	34,000	1	1.0	1.5	22	32	31	0	0	0
Connecticut	11,000	405	178,000	5	1.5	.8	122	30	25	0	0	0
New York	1,338,000	46,161	19,388,000	2,130	5.7	5.8	19,388	42	42	3,234	7	7
New Jersey	60,000	2,226	979,000	76	5.0	6.0	935	42	40	396	18	11
Pennsylvania	998,000	35,130	14,403,000	1,349	5.2	6.1	15,106	43	40	3,159	9	6
N. Atlantic	2,646,000	93,921	39,841,000	3,932	5.4	5.8	39,076	41.6	40.4	6,967	7.4	6.2
Delaware	4,000	135	58,000	2	1.5	2.7	35	26	28	10	10	10
Maryland	27,000	810	373,000	18	2.6	2.5	227	28	26	120	15	12
Virginia	194,000	4,268	2,091,000	106	2.8	2.6	1,280	30	31	430	10	6
West Virginia	100,000	2,520	1,260,000	60	2.8	4.0	731	29	33	75	3	4
North Carolina	190,000	3,458	2,075,000	32	1.0	2.1	692	20	22	105	3	3
South Carolina	219,000	4,599	2,989,000	111	2.5	1.6	874	19	14	138	3	3
Georgia	343,000	6,243	3,996,000	113	1.7	2.1	936	15	15	248	4	2
Florida	31,000	502	326,000	5	1.0	2.3	100	20	16	20	4	3
S. Atlantic	1,108,000	22,535	13,168,000	447	2.1	2.3	4,875	21.6	21.9	1,146	5.1	3.9
Ohio	1,765,000	65,658	22,980,000	3,036	5.4	6.7	24,293	37	36	21,681	33	30
Indiana	1,850,000	65,490	20,302,000	2,220	4.0	4.8	20,957	32	30	28,820	44	42
Illinois	4,500,000	171,000	51,300,000	8,430	5.3	5.1	63,270	37	34	92,340	54	49
Michigan	1,505,000	51,170	17,910,000	2,642	6.1	5.7	19,956	39	38	14,336	28	26
Wisconsin	2,320,000	69,136	23,506,000	6,783	8.5	8.1	29,728	43	42	8,983	13	19
N. C. E. Miss. R.	11,940,000	422,454	135,998,000	23,111	5.9	6.2	158,204	37.4	36.4	166,160	39.3	34.3
Minnesota	2,736,000	78,523	25,127,000	8,126	9.0	7.9	28,268	36	40	18,055	23	29
Iowa	4,800,000	181,440	48,989,000	9,868	8.5	6.2	76,205	42	36	76,188	42	35
Missouri	780,000	26,208	8,387,000	652	3.5	4.4	10,483	40	34	5,240	20	14
North Dakota	1,628,000	11,396	4,217,000	4,365	8.8	6.0	3,419	30	47	456	4	15
South Dakota	1,525,000	35,075	10,522,000	3,176	7.3	6.6	12,276	35	43	9,126	26	23
Nebraska	2,650,000	74,200	20,776,000	4,637	7.5	6.0	34,132	46	39	23,002	31	37
Kansas	1,400,000	46,620	15,851,000	816	3.0	4.3	19,580	42	34	9,320	20	15
N. C. W. Miss. R.	15,519,000	453,462	133,869,000	31,640	7.8	6.3	184,363	40.7	38.9	141,387	31.2	29.0
Kentucky	170,000	4,250	1,912,000	77	2.0	3.4	1,318	31	32	344	8	6
Tennessee	200,000	4,600	2,116,000	68	1.7	2.7	1,242	27	27	1,012	22	13
Alabama	297,000	5,494	3,296,000	67	1.5	3.0	769	14	15	110	2	2
Mississippi	175,000	3,360	1,848,000	36	1.5	3.6	538	16	16	34	1	1
Louisiana	36,000	774	379,000	12	1.8	1.1	155	20	14	8	1	0
Texas	695,000	24,325	11,433,000	172	1.5	2.8	4,865	20	16	6,075	25	20
Oklahoma	632,000	23,068	8,535,000	160	1.0	3.0	6,459	28	28	5,775	25	20
Arkansas	172,000	4,730	2,176,000	56	1.5	2.2	1,466	31	25	235	5	3
S. Central	2,377,000	70,601	31,695,000	648	1.4	2.9	16,812	23.8	21.4	13,593	19.2	16.4
Montana	350,000	13,300	6,118,000	1,077	7.0	7.2	4,788	36	39	5,187	39	32
Wyoming	130,000	4,160	2,080,000	192	5.5	3.6	1,456	35	30	840	20	9
Colorado	202,000	7,898	3,633,000	261	3.5	5.0	2,211	28	34	1,738	22	27
New Mexico	30,000	822	510,000	38	4.0	3.2	140	17	21	80	10	10
Arizona	4,000	160	144,000	2	1.4	.8	18	11	24	18	9	9
Utah	58,000	2,494	1,197,000	127	5.0	5.0	873	35	30	650	26	23
Nevada	7,000	313	197,000	7	2.5	4.0	78	25	23	45	15	10
Idaho	184,000	7,084	2,975,000	467	6.0	4.0	2,125	30	28	3,195	45	40
Washington	206,000	8,817	4,232,000	396	4.0	3.7	2,204	25	27	3,696	42	36
Oregon	302,000	10,419	4,897,000	653	6.0	5.0	3,230	31	29	3,432	33	33
California	225,000	8,325	4,162,000	251	4.0	2.7	1,082	13	13	3,320	40	32
Far Western	1,698,000	63,792	30,145,000	3,471	5.3	4.8	18,205	28.5	29.3	22,201	34.8	31.3
United States	35,288,000	1,126,765	384,716,000	63,249	6.3	5.8	421,535	37.4	36.4	351,454	31.2	28.1

OATS—Continued.

Average yield per acre of oats in the United States.

State, Territory, or Division.	10-year averages.				1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	1909.	1910.
	1866–1875.	1876–1885.	1886–1895.	1896–1905.										
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*
Maine	26.1	26.8	32.0	36.8	35.0	39.0	39.5	36.6	39.5	35.8	37.1	34.0	37.0	42.4
New Hampshire	32.5	34.9	32.1	33.5	29.5	35.0	31.1	33.2	32.8	34.5	32.5	30.6	31.5	42.8
Vermont	34.9	34.7	33.8	37.2	33.0	40.0	38.2	37.9	39.4	37.2	34.0	33.3	32.2	41.5
Massachusetts	30.5	31.0	30.9	33.1	31.0	32.2	31.7	34.0	32.0	34.0	35.0	33.0	31.0	35.5
Rhode Island	31.4	28.5	28.4	29.4	29.4	36.2	28.1	25.4	29.4	29.3	29.5	31.0	25.0	35.0
Connecticut	31.2	28.0	26.6	30.8	28.7	34.5	31.2	33.5	34.5	34.2	31.5	32.6	27.5	36.8
New York	32.2	30.5	26.2	31.4	21.6	40.0	34.0	34.1	34.2	32.3	30.7	30.1	28.2	34.5
New Jersey	28.3	29.0	26.0	27.0	16.0	32.2	25.4	32.5	32.0	26.6	29.5	30.7	25.5	37.1
Pennsylvania	30.6	30.2	25.7	29.8	18.9	36.5	28.6	33.9	34.0	27.4	29.6	27.3	26.0	35.2
North Atlantic	31.2	30.4	26.5	31.0	21.2	38.2	31.8	34.2	34.4	30.4	30.7	29.3	27.9	35.5
Delaware	16.6	22.6	19.9	23.7	18.5	22.6	22.2	28.2	31.2	24.5	30.0	29.8	25.5	33.8
Maryland	19.9	20.7	19.9	23.8	18.8	26.7	20.6	29.7	27.7	25.4	27.5	25.5	25.4	30.0
Virginia	16.4	12.1	13.5	16.0	14.9	17.5	13.8	21.1	17.8	18.0	19.6	19.1	19.0	22.0
West Virginia	23.6	20.0	19.3	22.7	18.7	28.6	21.7	26.4	24.1	20.6	19.3	19.0	22.0	25.2
North Carolina	13.8	11.4	11.1	13.5	14.4	12.7	11.4	15.8	15.3	16.2	15.6	16.5	16.5	18.2
South Carolina	10.4	12.0	11.1	14.8	15.8	13.1	14.0	17.1	16.3	18.5	20.0	20.0	21.0	21.0
Georgia	12.0	11.2	11.6	13.6	14.8	11.1	13.6	14.8	15.1	15.5	16.7	17.2	19.0	18.2
Florida	13.9	11.5	11.2	12.2	13.1	13.6	13.2	12.9	12.0	14.0	13.7	14.5	17.0	16.2
South Atlantic	16.5	12.6	12.9	15.4	15.3	15.2	14.2	18.2	17.1	17.6	18.1	18.3	19.3	20.3
Ohio	29.6	30.6	29.3	34.8	31.5	41.1	30.6	40.9	35.8	32.8	22.8	26.4	32.5	37.2
Indiana	25.2	26.7	26.4	31.0	28.6	35.4	24.4	33.1	35.3	28.2	20.2	21.2	30.5	35.4
Illinois	30.5	33.2	30.4	32.5	28.2	37.7	26.6	32.0	35.5	29.5	24.5	23.0	36.6	38.0
Michigan	32.2	33.0	28.9	32.7	29.0	39.9	30.5	32.5	35.6	30.7	20.8	29.7	30.5	34.0
Wisconsin	33.9	33.1	30.3	34.9	29.1	39.9	32.8	35.0	39.0	37.4	22.0	31.1	35.0	29.8
North Central east of Mississippi River	30.6	31.9	29.6	33.2	28.9	38.5	28.8	34.1	36.4	31.7	22.6	25.8	34.0	35.4
Minnesota	35.1	34.3	31.0	33.3	32.1	39.0	32.3	39.2	37.5	32.5	24.5	22.0	33.0	28.7
Iowa	35.8	33.0	31.4	31.0	29.8	30.7	24.0	32.0	35.0	33.8	24.2	24.3	27.0	37.8
Missouri	29.4	26.6	24.0	22.5	11.2	32.5	22.1	22.7	27.2	22.8	21.5	19.3	27.0	33.6
North Dakota	.....	.....	28.0	29.1	32.6	38.4	27.4	37.4	38.9	32.5	24.5	23.4	32.0	7.0
South Dakota	.....	.....	22.6	30.4	28.8	34.8	38.6	39.0	39.0	36.4	24.7	23.0	30.0	23.0
Nebraska	34.9	30.5	24.2	28.0	19.8	34.6	29.5	30.7	31.0	29.5	20.4	22.0	25.0	28.0
Kansas	32.8	30.6	24.5	23.9	18.6	33.5	26.2	17.8	27.1	23.6	15.0	22.0	28.2	33.3
North Central west of Mississippi River	33.4	31.1	27.7	29.6	26.2	34.0	27.9	32.2	34.4	31.5	22.8	22.8	28.7	29.2
Kentucky	21.4	19.7	18.9	21.1	19.7	22.2	20.1	24.0	24.5	21.5	17.6	16.2	22.3	25.0
Tennessee	17.5	16.0	14.8	17.0	17.5	17.3	18.5	21.1	20.2	21.5	20.8	21.0	20.0	23.0
Alabama	13.0	12.3	12.0	14.1	14.5	10.9	15.8	14.9	16.5	17.2	17.5	18.0	16.5	18.5
Mississippi	15.1	13.0	12.3	15.3	15.2	15.4	15.0	19.2	18.5	18.0	17.9	17.5	16.0	19.2
Louisiana	16.5	13.7	13.5	16.1	13.4	15.2	15.9	18.4	16.0	17.2	14.5	20.0	20.0	21.5
Texas	26.5	27.7	23.1	27.6	16.3	23.2	35.5	32.0	31.4	34.8	19.0	28.9	18.7	35.0
Oklahoma	.....	.....	.....	30.5	22.7	41.7	27.9	26.0	34.2	34.3	15.0	25.0	29.0	36.5
Arkansas	21.7	18.9	17.9	19.1	12.3	20.0	18.6	22.7	20.3	20.5	19.5	21.4	22.8	27.5
South Central	19.7	17.6	17.4	23.2	17.1	24.3	26.7	26.1	27.7	29.3	17.8	23.7	21.6	29.7
Montana	.....	35.9	32.7	41.0	42.0	41.9	46.4	37.7	41.3	43.2	49.0	41.6	51.3	38.0
Wyoming	.....	29.7	30.4	33.9	41.0	36.0	29.4	30.2	39.9	39.5	37.0	36.4	35.0	32.0
Colorado	.....	30.7	28.5	32.2	33.8	26.8	33.3	35.4	35.0	40.4	38.0	39.5	38.0	39.1
New Mexico	.....	18.5	27.5	27.8	31.6	19.1	22.6	19.6	29.5	34.6	38.5	33.5	40.0	27.4
Arizona	.....	25.0	.....	32.7	35.0	31.7	35.5	30.1	31.2	34.4	29.0	36.0	37.0	40.1
Utah	.....	25.1	28.6	36.5	33.0	35.5	36.4	37.6	39.8	43.7	45.0	49.5	46.1	43.0
Nevada	34.4	31.0	27.4	36.1	43.0	34.8	28.6	37.0	37.2	38.8	43.0	45.0	40.0	44.7
Idaho	.....	33.5	31.4	39.3	38.3	42.1	41.5	39.3	39.4	40.7	50.5	44.0	44.5	38.5
Washington	.....	38.3	35.8	43.4	47.5	46.2	47.9	44.9	50.0	43.2	55.5	44.5	49.0	42.8
Oregon	35.0	31.7	27.6	27.0	31.5	28.7	33.8	23.1	24.1	33.8	35.0	33.4	37.8	34.5
California	33.8	27.9	28.0	29.5	30.4	30.5	34.8	34.1	28.0	31.5	33.5	33.5	31.4	37.0
Far Western	34.4	31.4	29.5	33.7	36.3	34.6	38.1	33.9	35.1	38.5	43.0	39.0	42.0	37.6
United States	28.1	27.6	25.6	29.6	25.8	34.5	28.4	32.1	34.0	3 .2	23.7	25.0	30.3	31.9

OATS—Continued.

Average farm value per acre of oats in the United States December 1.

State, Territory, or Division.	10-year averages.				1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	1909.	1910.
	1866–1875.	1876–1885.	1886–1895.	1896–1905.										
	Dolls.	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*
Maine	14.09	12.06	13.76	14.72	17.50	17.55	17.77	16.47	16.55	15.75	22.26	20.40	21.46	20.35
N. Hampshire	17.55	16.05	14.12	14.07	15.34	15.40	14.93	15.60	14.10	15.18	19.85	18.08	20.14	21.79
Vermont	17.10	14.57	13.86	14.51	16.50	17.20	16.81	16.68	15.76	16.00	21.42	20.65	16.10	20.75
Massachusetts	18.00	15.50	13.60	13.90	17.05	14.49	15.53	15.30	13.76	14.96	21.00	20.43	18.00	17.71
Rhode Island	17.27	14.25	12.78	12.05	15.88	15.57	12.65	11.94	12.35	13.19	19.50	20.00	13.00	17.00
Connecticut	18.10	13.44	11.17	12.32	15.50	14.14	14.04	14.74	14.49	14.36	18.90	18.91	14.55	16.18
New York	14.81	11.90	9.43	10.99	10.37	14.40	13.94	12.96	12.65	12.92	17.50	16.86	13.82	14.49
New Jersey	13.30	11.31	9.88	9.72	7.52	12.56	10.92	13.00	11.84	10.11	16.52	16.88	12.75	16.32
Pennsylvania	12.85	11.17	9.25	9.83	8.50	12.41	10.58	12.88	12.24	10.41	15.98	15.01	13.00	14.43
N. Atlantic	14.07	11.80	9.73	10.73	9.99	13.70	12.68	13.21	12.73	12.00	17.25	16.44	13.96	15.06
Delaware	6.97	8.36	7.16	8.06	8.33	9.49	8.88	11.56	12.48	9.31	15.00	16.00	12.25	14.50
Maryland	8.36	7.66	6.96	7.85	7.71	10.15	8.24	10.69	9.97	9.65	13.47	13.50	12.43	13.81
Virginia	6.56	4.96	5.00	5.76	6.26	7.35	5.93	9.07	6.94	7.74	9.80	10.50	10.26	10.78
W. Virginia	8.97	7.20	7.14	8.40	8.04	11.73	9.98	11.62	9.40	8.24	10.42	10.64	11.88	12.60
N. Carolina	7.45	5.59	5.00	6.08	7.34	6.48	5.93	8.22	7.19	7.94	9.36	10.40	10.89	10.92
S. Carolina	7.59	7.80	6.10	7.84	9.80	7.73	8.26	10.26	8.96	10.54	14.40	15.00	15.12	13.65
Georgia	8.64	6.94	6.26	7.07	9.92	5.88	7.48	8.14	8.00	8.68	12.02	12.38	13.49	11.65
Florida	12.51	9.32	6.72	6.47	9.43	8.30	7.92	7.74	6.24	9.52	10.27	10.43	12.74	10.52
S. Atlantic	7.69	6.39	5.73	6.79	8.36	7.37	7.26	9.15	7.97	8.76	11.49	11.97	12.57	11.88
Ohio	10.06	9.79	8.79	9.74	12.28	13.15	11.02	13.09	11.10	10.82	10.26	12.94	13.32	13.02
Indiana	7.81	7.74	7.66	8.06	10.87	9.91	7.81	9.93	9.53	9.02	8.48	9.96	11.90	10.97
Illinois	8.54	8.96	8.21	8.45	11.28	10.56	8.51	9.60	9.94	9.14	10.05	10.81	13.91	11.40
Michigan	11.91	11.22	9.25	9.81	11.89	13.17	10.98	10.72	10.68	10.13	9.98	14.55	12.50	11.90
Wisconsin	11.53	9.60	8.48	9.07	11.35	11.97	11.15	9.80	10.53	11.59	10.34	14.62	13.65	10.13
N. C. E. of Miss. R.	9.67	9.35	8.41	8.83	11.41	11.36	9.64	10.25	10.24	10.04	9.88	12.28	13.28	11.39
Minnesota	11.93	9.60	8.06	7.99	10.91	10.53	9.69	10.19	9.00	8.77	10.05	9.46	11.55	9.18
Iowa	8.95	7.59	7.54	7.13	10.73	7.67	6.96	8.00	8.40	9.13	9.20	10.21	9.45	10.21
Missouri	8.82	7.18	6.24	6.08	4.82	9.10	7.07	7.72	8.16	7.52	8.81	8.69	11.61	10.75
N. Dakota	......	......	7.00	7.86	10.76	10.37	8.49	8.98	8.95	8.78	9.80	9.83	10.56	2.59
S. Dakota	......	......	5.65	7.30	9.79	10.09	11.19	9.75	8.97	9.10	9.63	9.43	10.20	6.90
Nebraska	10.12	6.71	5.57	6.44	7.33	8.65	7.97	7.67	7.44	7.67	7.55	9.02	8.75	7.84
Kansas	10.17	7.65	6.37	6.21	8.00	10.05	7.86	5.87	7.59	7.32	6.30	9.90	12.13	11.32
N. C. W. of Miss. R.	9.65	7.74	6.87	7.07	9.42	9.01	8.15	8.36	8.37	8.53	8.91	9.62	10.22	8.63
Kentucky	8.35	7.09	6.43	6.96	8.08	7.99	8.24	9.60	8.58	8.17	8.62	8.75	11.38	11.25
Tennessee	7.35	6.24	5.18	5.95	7.87	7.27	7.77	7.80	7.88	8.82	10.40	11.13	10.60	10.58
Alabama	9.36	7.63	6.36	6.91	9.28	6.00	8.53	8.05	8.42	8.77	11.72	11.88	11.55	11.10
Mississippi	12.38	8.32	6.40	7.50	9.58	7.85	7.65	9.98	9.25	8.82	11.63	11.73	10.88	10.56
Louisiana	16.17	8.63	6.48	7.08	8.04	7.60	7.31	8.28	7.20	7.74	7.96	12.80	12.41	10.53
Texas	18.82	13.57	9.24	10.76	9.78	11.37	15.62	14.08	12.56	14.27	11.40	15.03	11.59	16.45
Oklahoma	......	......	......	11.28	10.86	14.57	9.60	9.63	10.51	10.14	7.20	11.25	13.34	13.50
Arkansas	13.02	9.26	7.34	7.45	7.01	8.20	8.18	9.76	8.53	8.61	10.53	11.34	13.45	12.65
S. Central	9.02	8.34	6.84	8.93	9.19	10.28	11.27	11.10	10.53	11.20	9.95	12.49	12.03	13.33
Montana	......	18.67	14.39	15.58	15.12	15.08	16.24	17.34	17.76	19.01	22.54	20.38	21.55	17.48
Wyoming	......	14.26	13.07	14.92	19.68	18.00	14.70	11.78	16.36	15.80	19.62	18.21	17.50	16.00
Colorado	......	18.42	11.40	13.52	16.90	13.67	13.65	16.28	14.35	18.18	19.00	21.33	20.14	17.99
New Mexico	......	10.73	13.20	14.46	18.96	12.99	14.01	11.17	17.11	17.99	21.17	21.46	26.42	17.00
Arizona	......	15.50	......	21.91	21.00	23.78	21.65	22.27	19.97	22.36	17.50	26.75	29.25	36.00
Utah	......	11.80	11.44	15.70	16.83	16.68	17.84	17.67	17.51	19.66	21.60	23.77	23.98	20.64
Nevada	31.99	20.46	14.80	23.46	30.16	24.36	19.45	23.31	19.34	24.83	31.00	29.29	23.57	28.14
Idaho	......	18.09	13.50	15.72	16.85	20.21	18.68	19.65	16.55	17.50	21.21	20.68	22.25	16.17
Washington	......	16.47	13.60	17.36	16.63	22.64	18.20	19.31	20.50	17.71	24.97	21.36	23.52	20.54
Oregon	18.55	13.95	10.49	10.80	10.71	11.77	14.87	10.86	10.36	14.53	15.75	15.70	19.66	16.22
California	23.66	17.02	13.44	14.46	13.38	15.55	18.79	19.44	14.28	16.38	23.79	22.44	20.72	18.50
Far Western	21.12	15.42	11.95	14.15	14.60	15.77	16.43	16.16	15.23	17.06	20.81	20.08	21.18	17.75
United States	10.62	9.03	7.63	8.32	10.29	10.60	9.68	10.05	9.88	9.89	10.51	11.78	12.29	10.90

OATS—Continued.

Average farm price of oats per bushel in the United States.

State, Territory, or Division.	Price December 1, by decades.				Price December 1, by years.									Price bimonthly, 1910.					
	1866-1875.	1876-1885.	1886-1895.	1896-1905.	1901	1902	1903	1904	1905	1906	1907	1908	1909	Feb. 1.	Apr. 1.	June 1.	Aug. 1.	Oct. 1.	Dec. 1.
	Cts.	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*
Maine	54	45	43	40	50	45	45	45	43	44	60	60	58	62	61	62	58	57	48
New Hampshire	54	46	44	42	52	44	48	47	43	44	61	59	64	59	59	62	62	59	51
Vermont	49	42	41	39	50	43	44	44	40	43	63	62	50	59	62	59	53	52	50
Massachusetts	59	50	44	42	55	45	49	45	43	44	60	62	58	57	61	55	57	51	50
Rhode Island	55	50	45	41	54	43	45	47	42	45	66	64	53	60	55	58	55	50	48
Connecticut	58	48	42	40	54	41	45	44	42	42	60	58	53	56	57	56	54	53	44
New York	46	39	36	35	48	36	41	38	37	40	57	56	49	51	55	53	53	46	42
New Jersey	47	39	38	36	47	39	43	40	37	38	56	55	50	55	58	58	53	46	44
Pennsylvania	42	37	36	33	45	34	37	38	36	38	54	55	50	52	56	53	51	44	41
North Atlantic	45.1	38.8	36.7	34.6	47.1	35.9	39.9	38.6	37.0	39.5	56.2	56.1	50.1	52.5	56.1	54.0	52.6	46.3	42.4
Delaware	42	37	36	34	45	42	40	41	40	38	50	54	48	52	48	50	49	40	43
Maryland	42	37	35	33	41	38	40	36	36	38	49	53	49	52	54	55	50	47	46
Virginia	40	41	37	36	42	42	43	43	39	43	50	55	54	59	62	59	54	53	49
West Virginia	38	36	37	37	43	41	46	44	39	40	54	56	54	57	60	61	59	53	50
North Carolina	54	49	45	45	51	51	52	52	47	49	60	63	66	66	70	68	65	63	60
South Carolina	73	65	55	53	62	59	59	60	55	57	72	75	72	72	71	70	69	70	65
Georgia	72	62	54	52	67	53	55	55	53	56	72	72	71	71	73	72	69	66	64
Florida	90	81	60	53	72	61	60	60	52	68	75	72	75	80	76	77	75	75	65
South Atlantic	46.6	50.7	44.4	44.1	54.5	48.5	51.1	50.2	46.7	49.8	63.5	65.4	65.0	66.6	68.3	67.2	64.2	63.0	58.4
Ohio	34	32	30	28	39	32	36	32	31	33	45	49	41	45	45	44	41	36	35
Indiana	31	29	29	26	38	28	32	30	27	32	42	47	39	44	44	41	37	33	31
Illinois	28	27	27	26	40	28	32	30	28	31	41	47	38	44	43	40	36	30	30
Michigan	37	34	32	30	41	33	36	33	30	33	48	49	41	47	50	46	44	39	35
Wisconsin	34	29	28	26	39	30	34	28	27	31	47	47	39	44	43	41	44	37	34
N.C. E. of Miss. River	31.6	29.3	28.4	26.6	39.5	29.5	33.5	30.1	28.1	31.7	43.7	47.6	39.1	44.5	44.2	41.6	39.4	33.7	32.2
Minnesota	34	28	26	24	34	27	30	26	24	27	41	43	35	39	39	36	41	33	32
Iowa	25	23	24	23	36	25	29	25	24	27	38	42	35	41	41	37	35	28	27
Missouri	30	27	26	27	43	28	32	34	30	33	41	45	43	46	49	47	39	31	32
North Dakota	....	....	29	27	33	27	31	24	23	27	40	42	33	38	39	34	45	38	37
South Dakota	....	....	25	24	34	29	29	25	23	25	39	41	34	39	39	37	39	35	30
Nebraska	29	22	23	23	37	25	27	25	24	26	37	41	35	39	39	36	36	31	28
Kansas	31	25	26	26	43	30	30	33	28	31	42	45	43	46	51	49	39	38	34
N. C. W. of Miss. River	28.9	24.9	24.8	23.9	36.0	26.5	29.2	25.9	24.4	27.1	39.1	42.2	35.5	40.2	40.8	37.5	38.6	32.3	29.5
Kentucky	39	36	34	33	41	36	41	40	35	38	49	54	51	53	57	56	50	48	45
Tennessee	42	39	35	35	45	42	42	37	39	41	50	53	53	58	60	62	53	49	46
Alabama	72	62	53	49	64	55	54	54	51	51	67	66	70	72	73	70	68	65	60
Mississippi	82	64	52	49	63	51	51	52	50	49	65	67	68	69	67	67	65	66	55
Louisiana	98	63	48	44	60	50	46	45	45	45	55	64	62	56	61	56	56	50	49
Texas	71	49	40	39	60	49	44	44	40	41	60	52	62	65	67	60	45	47	47
Oklahoma	....	....	....	37	48	35	34	37	31	30	48	45	46	53	55	52	36	36	37
Arkansas	60	49	41	39	57	41	44	43	42	42	54	53	59	62	65	63	56	49	46
South Central	45.8	47.4	39.3	38.5	53.8	42.3	42.3	42.5	38.0	38.3	55.9	52.7	55.7	59.5	61.6	58.4	47.1	46.1	44.9
Montana	....	52	44	38	36	36	35	46	43	44	46	49	42	44	46	52	49	48	46
Wyoming	....	48	43	44	48	50	50	39	41	40	53	50	50	65	55	58	64	60	50
Colorado	....	60	40	42	50	51	41	46	41	45	50	54	53	54	57	57	56	47	46
New Mexico	....	58	48	52	60	68	62	57	58	52	55	64	66	65	66	50	68	54	62
Arizona	....	62	....	67	60	75	61	74	64	65	60	74	79	85	95	64	42	85	90
Utah	....	47	40	43	51	47	49	47	44	45	48	48	52	55	59	60	60	48	48
Nevada	93	66	54	65	70	70	68	63	52	64	72	65	59	57	75	73	80	64	63
Idaho	....	54	43	40	44	48	45	50	42	43	42	47	50	51	50	51	44	45	42
Washington	....	43	38	40	35	49	38	43	41	41	45	48	48	48	52	50	48	47	48
Oregon	53	44	38	40	34	41	44	47	43	43	45	47	52	50	54	54	53	47	47
California	70	61	48	49	44	51	54	57	51	52	71	67	66	63	63	60	52	49	50
Far Western	61.4	49.1	40.5	42.0	40.3	45.6	43.1	47.6	43.3	44.3	48.4	51.5	50.4	51.4	53.0	53.9	51.7	48.1	47.3
United States	37.8	32.7	29.8	28.1	39.9	30.7	34.1	31.3	29.1	31.7	44.3	47.2	40.5	45.0	45.6	43.0	41.7	36.2	34.1

OATS—Continued.

Wholesale prices of oats per bushel, 1897–1910.

Date.	New York.		Baltimore.		Cincinnati.		Chicago.		Milwaukee.		Duluth.		Detroit.		San Francisco.	
	No. 2, mixed.		No. 2, mixed.		No. 2, mixed.		No. 2.		No. 2, white.		No. 2.*a*		No. 2, white.		No. 1, white (per 100 lbs.).	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.
	Cts.	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*		
1897....	21	29¼	21	28	16¾	25	15⅝	23⅞	16½	26	16¼	25½	19½	26	$1.12½	$1.30
1898....	25½	36	24	36	21½	34½	20¼	32	22¾	34½	20	33¼	23¼	36¼	1.15	1.42½
1899....	25¾	35½	24½	35	21½	31½	19¼	28¼	22¾	31½	19½	30½	23½	33	1.22½	1.45
1900....	24¾	29¾	24	29½	21	28	21	26¼	24	29	22½	28	24	29¼	1.22½	1.40
1901....	28¼	52	28	53	25	50¾	23¼	48¼	25½	48¾	25¼	46⅞	28	60½	1.02½	1.55
1902....	32	65	29	60	27	57	25	56	30½	58	27½	47⅛	34¾	61	1.15	1.50
1903....	38	44½	34½	44	31½	43½	31¼	45	33½	41	31	40	35½	45	1.17½	1.37½
1904....	34½	55½	33	48	31	44½	28¼	46	28½	45	27¾	43	31¾	48¼	1.25	1.60
1905....	29	37½	27½	37	25	35½	25	34¼	27⅕	35½	25¼	32¾	26¼	37	1.37½	1.80
1906....	34	45	33½	45½	30	43	28⅞	42¾	29	43	28⅛	41	32	43¼	......	......
1907.							Contract.		No. 3, white		No. 3.		No. 3, white			
Jan....	38½	42	39½	42	37	40	33½	37¼	32¾	38	33½	37	37	41½	1.42½	1.65
Feb....	41½	47½	41½	47	39½	45	37	41¼	37¼	42	37	39	42½	44¾	1.45	1.67½
Mar....	46½	48½	47	49	44	45½	39⅜	43	39¾	43	38	41	41	45½	1.45	1.70
Apr....	45½	47½	46½	49½	43	44½	41½	45½	40	43	39	42	42½	47½	1.50	1.75
May....	46½	50	45½	48	43½	47	44½	48½	42	48	41	44	46	49½	1.55	1.75
June...	48½	50½	46½	49½	46	50	41⅜	49⅜	41½	48	40½	44½	46½	50	1.40	1.70
July....	48½	49½	47	50½	45½	47½	41⅛	46	41¼	46½	40	42	47¼	50	1.30	1.60
Aug....	50½	63	50½	59½	45	53	44⅞	54	45	54½	41	48	49	56	1.42½	1.55
Sept...	51	53	52	54½	49	52	51	56½	47	56	48	51	52	56	1.45	1.60
Oct....	50½	55½	53	57	44½	55½	45	54¾	39	54½	46	53	50	58	1.50	1.80
Nov....	51	52½	50	53½	45	49	44½	49	45	50¼	45	48	52	53	1.60	1.85
Dec....	51½	54½	50	54½	48	53	46½	50⅞	46½	53	46	49	52	54¼	1.55	1.70
Year.	38½	63	39½	59½	37	55½	33½	56½	32¾	56	33½	53	37	58	1.30	1.85
1908.																
Jan....	53	53½	53	54½	51½	52½	48¼	51½	49	52¼	46½	49	53¼	54	1.55	1.70
Feb....	53	57½	52½	56½	50½	53	48¼	53⅜	47½	53	47	50	53	55½	1.55	1.70
Mar....	55	57	56	57½	52½	54	52⅛	54⅝	50½	54½	49½	51	54¾	56	1.45	1.65
Apr....	54	54½	55½	56½	51	53	51¾	53⅞	50	53¼	47	49½	55	57	1.50	1.65
May....	53½	57	56	57	50½	54½	52¾	56½	51½	56	49	51	55	56	1.47½	1.62½
June...	52½	56	55½	57½	52	54½	50	53	48	54½	48½	50½	55	56	1.40	1.57½
July....	53½	61½	57	62	50	60	51	60½	47½	62½	49	57	55	64	1.40	1.55
Aug....	50½	59½	50½	62	48	51½	46	50	45	47	46⅜	56	47	62	1.45	1.60
Sept...	52	53	51	52	50	53	48	50¼	46	51¼	46¾	49½	49	53	1.60	1.67½
Oct....	51	53	50½	51½	47	51½	46¾	49	45½	52	45¼	47¾	50½	52½	1.60	1.68¾
Nov....	51½	55	51	54	48	52½	47⅜	49½	47	53	46	48½	51½	53	1.65	1.75
Dec....	52½	56	53	55	50½	52½	48⅜	50½	48¼	52½	47½	50	51	54	1.70	1.75
Year.	51	61½	50½	62	47	60	46	60½	45	62½	45¾	57	47	64	1.40	1.75
1909.																
Jan....	53½	54	54	54½	51	53½	49¼	50¼	49	51½	48¼	49⅛	52	53¼	1.70	1.90
Feb....	53½	57½	54	56	53	55	50	55¼	50½	55	48¾	51⅞	53½	57	1.85	1.92½
Mar....	56½	58	55½	58	53½	56½	52⅜	52⅝	51¼	55½	50½	53	55	57	1.87½	2.02½
Apr....	56½	58½	56	58	53½	56½	53	56¼	52½	56½	51⅛	53¾	57¼	57⅝	2.05	2.25
May....	58½	62	58	62½	56	62	56¼	62½	56	62½	53¾	58½	57½	64½	2.15	2.25
June...	59½	61½	58½	62½	55	60½	53¾	59	49	59½	50	57½	56½	62½	2.05	2.25
July....	52½	59½	51	58½	45	55½	44½	53½	46	55½	40	50	50½	56½	1.95	2.15
Aug....	39½	52½	38½	52	35½	45	36½	43	35½	50	33	37½	36½	51	......	......
Sept...	39½	42	38½	42½	35½	42½	37¾	48	37	41½	34¼	38¼	39	41½	......	......
Oct....	41	42½	42	43	40	43	38⅛	41½	38½	42	35⅞	38½	41	43½	1.55	1.62½
Nov....	42	43	42½	43½	40½	42½	38⅜	39¾	38½	42½	36¼	39⅜	41	41½	1.57½	1.70
Dec....	42½	47	43	49	41	47½	40	45	40	45½	39½	43¾	42	46½	1.65	1.80
Year.	39½	62	38½	62½	35½	62	36½	62½	35½	62½	33	58½	36½	64½	1.55	2.25
1910.																
Jan....	50⅛	50⅛	48½	53	47	52	44½	48½	45¼	49½	43¾	47½	47½	51	1.60	1.75
Feb....	50	51	51	53	48	50	46¼	49	46	49¼	44½	46¾	44½	50	1.60	1.66¼
Mar....	48½	50	48	52	46	49½	43	47¼	42	47¼	41⅜	46	47¼	48½	1.60	1.67½
Apr....	46	48½	46½	49	42½	47½	41½	43½	39	43½	39⅜	41½	44	46½	1.50	1.60
May....	42½	46½	44	47½	40	44½	36½	43¼	36	43	35⅝	41⅝	41	45¼	1.50	1.57½
June...	41	45	43	44½	37	41	35	40¼	36	41	35	39⅛	41	43	1.42½	1.55
July....	45	48½	44	47	39	44½	38¾	44½	38½	46¼	38⅜	43¾	40½	48½	1.42½	1.65
Aug....	35	47½	42½	47	32½	38½	32¾	38¾	33½	42	33⅛	38⅝	34½	43	1.57½	1.70
Sept...	34	34¼	35½	37½	32½	34½	31⅜	34½	32	35	31¼	35	34½	37	1.50	1.62½
Oct....	33½	34½	36	36	32	35	29¾	32¾	30	35	29	32⅞	35½	36	1.47½	1.60
Nov....	Nominal.		......	......	31½	34½	30⅝	31¾	31¾	33½	31	32¼	34½	35	1.47½	1.50
Dec....	Nominal.		......	......	32½	35	31	32½	31⅞	34½	30¾	33⅛	34	37	1.45	1.50
Year.	33½	51	35½	53	31½	52	29¾	49	30	49½	29	47½	34	51	1.42½	1.75

a "No grade" in 1905.

OATS—Continued.

Average farm price of oats per bushel, on the first of each month, 1909–1910.

Month.	United States.		North Atlantic States.		South Atlantic States.		N. Cen. States East of Miss. R.		N. Cen. States West of Miss. R.		South Central States.		Far Western States.	
	1910.	1909.	1910.	1909.	1910.	1909.	1910.	1909.	1910.	1909.	1910.	1909.	1910.	1909.
	Cts.	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*
January	42.8	48.1	50.7	56.8	66.4	65.5	41.8	48.1	38.1	42.8	56.9	55.2	51.2	53.4
February	45.0	48.1	52.5	55.7	66.6	65.7	44.5	48.4	40.2	43.2	59.5	56.0	51.4	51.1
March	46.0	51.1	54.9	57.9	67.9	68.8	45.3	51.3	41.0	45.6	61.7	61.6	53.9	58.0
April	45.6	53.2	56.1	60.1	68.3	71.3	44.2	52.7	40.8	47.9	61.6	62.7	53.0	63.5
May	43.3	55.3	55.3	62.9	66.7	71.4	42.2	54.5	37.7	49.7	60.0	64.4	52.4	68.9
June	43.0	57.4	54.0	65.2	67.2	71.6	41.6	56.3	37.5	51.9	58.4	65.7	53.9	72.1
July	42.1	56.2	52.3	65.1	66.0	71.6	40.9	54.9	37.7	50.3	51.0	63.7	51.0	73.1
August	41.7	50.0	52.6	63.3	64.2	67.8	39.4	47.6	38.6	44.7	47.1	53.3	51.7	66.5
September	38.4	42.3	48.8	55.4	63.9	68.4	35.1	40.3	34.6	34.6	46.4	56.9	50.9	57.1
October	36.2	41.0	46.3	51.4	63.0	68.4	33.7	38.9	32.3	34.3	46.1	56.9	48.1	53.6
November	34.9	41.0	43.7	50.1	61.2	64.3	33.2	39.4	30.6	34.7	45.3	57.5	46.0	50.0
December	34.1	40.5	42.4	50.1	58.4	65.0	32.2	39.1	29.5	35.5	44.9	55.7	47.3	50.4

BARLEY.

Barley area of countries named, 1906–1910.

Country.	1906.	1907.	1908.	1909.	1910.
NORTH AMERICA.	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*
United States	6,323,800	6,448,000	6,646,000	7,011,000	7,257,000
Canada:					
New Brunswick	4,300	4,100	3,500	3,200	2,900
Ontario	756,200	766,900	743,800	721,500	696,700
Manitoba	474,200	649,600	662,500	696,000	684,100
Saskatchewan	53,600	79,300	81,000	135,000	137,400
Alberta	73,600	54,700	129,800	186,000	194,500
Other	(a)	128,700	125,100	123,200	118,400
Total Canada	....	1,683,300	1,745,700	1,864,900	1,834,000
Mexico	(a)	(a)	(a)	(a)	(a)
EUROPE.					
Austria-Hungary:					
Austria	2,909,100	2,882,500	2,757,200	2,795,500	2,721,900
Hungary proper	2,603,000	2,725,200	2,647,500	2,857,800	2,931,000
Croatia-Slavonia	164,600	160,900	159,800	156,700	159,600
Bosnia-Herzegovina	257,700	292,100	262,200	204,400	202,600
Total Austria-Hungary	5,934,400	6,060,700	5,826,700	6,014,400	6,015,100
Belgium	86,900	92,000	87,900	(a)	(a)
Bulgaria	572,300	573,800	621,100	596,000	610,000
Denmark	590,700	577,500	577,500	580,700	575,700
Finland	(a)	(a)	(a)	(a)	(a)
France	1,752,800	1,761,500	1,802,800	1,814,700	1,843,200
Germany	4,063,700	4,205,000	4,025,200	4,068,200	3,880,500
Italy	(a)	(a)	(a)	617,000	611,700
Netherlands	70,800	76,500	74,600	70,200	69,700
Norway	(a)	88,500	96,300	96,400	88,700
Roumania	1,380,600	1,259,500	1,532,500	1,357,100	1,357,500
Russia:					
Russia proper	19,823,300	20,403,200	21,913,700	21,801,100	....
Poland	1,185,800	1,212,200	1,243,100	1,236,400	....
Northern Caucasia	2,353,500	2,533,100	2,790,400	2,965,800	....
Total Russia (European) [b]	23,362,600	24,148,500	25,947,200	26,003,300	27,758,300
Servia	270,200	250,200	254,800	261,900	241,700
Spain	3,620,100	3,561,100	3,466,700	3,480,000	3,333,200
Sweden	502,800	487,000	483,000	476,900	476,900

[a] No official statistics of area; estimates of production on p. 533. [b] Exclusive of winter barley.

BARLEY—Continued.

Barley area of countries named, 1906–1910—Cotinued.

Country.	1906.	1907.	1908.	1909.	1910.
EUROPE—continued.					
United Kingdom:					
Great Britain—	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*
England	1,439,700	1,411,200	1,383,300	1,379,100	1,449,500
Scotland	218,700	210,300	197,400	200,000	191,600
Wales	92,800	90,600	86,700	85,300	87,600
Ireland	176,600	170,400	154,600	163,100	168,000
Total United Kingdom	1,927,800	1,882,500	1,822,000	1,827,500	1,896,700
ASIA.					
Cyprus	(a)	(a)	(a)	(a)	(a)
Japanese Empire:					
Japan	3,359,200	3,316,900	3,266,300	3,235,000	3,300,000
Formosa	(a)	(a)	(a)	(a)	(a)
Russia:					
Central Asia	148,700	216,500	232,900	292,400	
Siberia	307,300	315,800	355,600	412,600	
Transcaucasia	1,100	700	1,100	800	
Total Russia (Asiatic) [b]	457,100	533,000	589,600	705,800	693,300
AFRICA.					
Algeria	3,264,100	3,168,600	3,442,600	3,284,000	3,418,400
Egypt	477,500	472,700	475,800	457,300	439,400
Sudan (Anglo-Egyptian)	(a)	(a)	(a)	(a)	(a)
Tunis	1,030,400	1,188,500	1,088,800	1,136,300	1,186,100
Union of South Africa	(a)	(a)	(a)	(a)	(a)
AUSTRALASIA.					
Australia:					
Queensland	5,200	8,600	6,900	7,400	13,100
New South Wales	9,500	7,900	11,900	9,500	15,100
Victoria	40,900	52,800	63,100	65,200	58,600
South Australia	26,300	28,100	37,300	44,900	41,900
Western Australia	3,700	3,600	6,000	7,300	8,000
Tasmania	5,400	5,300	5,900	6,500	6,300
Total Australia	91,000	106,300	131,100	140,800	143,000
New Zealand	32,900	36,700	36,200	48,900	41,500
Total Australasia	123,900	143,000	167,300	189,700	184,500

[a] No official statistics of area; estimates of production on pp. 533-534. [b] Exclusive of winter barley.

Barley crop of countries named, 1906–1910.

Country.	1906.	1907.	1908.	1909.	1910.
NORTH AMERICA.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
United States	178,916,000	153,597,000	166,756,000	170,284,000	162,227,000
Canada:					
New Brunswick	99,000	97,000	79,000	94,000	73,000
Ontario	25,253,000	21,718,000	21,124,000	20,952,000	20,727,000
Manitoba	17,533,000	16,753,000	17,093,000	20,866,000	13,826,000
Saskatchewan	1,316,000	1,350,000	1,952,000	4,493,000	3,598,000
Alberta	2,158,000	1,083,000	3,881,000	5,999,000	3,953,000
Other	3,000,000	3,341,000	2,633,000	2,994,000	2,971,000
Total Canada	49,359,000	44,342,000	46,762,000	55,398,000	45,148,000
Mexico	7,615,000	7,000,000	7,000,000	7,000,000	7,000,000
Total	235,890,000	204,939,000	220,518,000	232,682,000	214,375,000
EUROPE.					
Austria-Hungary:					
Austria	76,024,000	78,555,000	69,497,000	79,368,000	67,618,000
Hungary proper	69,747,000	63,078,000	56,324,000	71,868,000	55,758,000
Croatia-Slavonia	2,758,000	2,064,000	2,552,000	2,394,000	2,732,000
Bosnia-Herzegovina	3,276,000	2,388,000	2,389,000	3,755,000	3,445,000
Total Austria-Hungary	151,805,000	146,085,000	130,762,000	157,385,000	129,553,000

BARLEY—Continued.

Barley crop of countries named, 1906–1910—Continued.

Country.	1906.	1907.	1908.	1909.	1910.
EUROPE—continued.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Belgium	4,349,000	5,129,000	4,409,000	5,000,000	4,000,000
Bulgaria	12,008,000	6,772,000	11,311,000	9,322,000	15,754,000
Denmark	19,975,000	21,616,000	20,166,000	21,599,000	21,713,000
Finland	5,376,000	5,124,000	6,000,000	5,000,000	4,775,000
France	36,538,000	43,043,000	40,673,000	46,144,000	44,532,000
Germany	142,901,000	160,650,000	140,539,000	160,552,000	133,330,000
Italy	8,000,000	8,000,000	9,000,000	10,951,000	9,483,000
Netherlands	3,260,000	4,091,000	3,953,000	3,332,000	3,383,000
Norway	3,262,000	2,597,000	3,028,000	2,596,000	2,900,000
Roumania	33,539,000	20,062,000	12,873,000	19,955,000	29,359,000
Russia:					
Russia proper	243,619,000	277,500,000	297,449,000	382,163,000	....
Poland	23,351,000	25,395,000	23,790,000	26,671,000	....
Northern Caucasia	37,306,000	41,206,000	46,219,000	55,900,000	....
Total Russia (European) [a]	304,276,000	344,101,000	367,458,000	464,734,000	448,832,000
Servia	4,848,000	3,137,000	3,351,000	3,123,000	2,067,000
Spain	90,264,000	53,598,000	69,596,000	81,579,000	76,308,000
Sweden	14,328,000	12,811,000	15,520,000	13,900,000	14,763,000
United Kingdom:					
Great Britain—					
England	51,543,000	51,926,000	46,353,000	52,323,000	50,245,000
Scotland	7,803,000	7,466,000	7,410,000	7,731,000	6,854,000
Wales	3,116,000	2,881,000	2,682,000	2,804,000	2,937,000
Ireland	7,144,000	6,934,000	7,064,000	8,258,000	6,846,000
Total United Kingdom	69,606,000	69,207,000	63,509,000	71,116,000	66,882,000
Total	904,335,000	906,023,000	902,148,000	1,076,288,000	1,007,634,000
ASIA.					
Cyprus	2,778,000	2,963,000	2,420,000	2,500,000	2,500,000
Japanese Empire:					
Japan	83,968,000	90,544,000	87,138,000	87,167,000	88,000,000
Formosa	49,000	50,000	50,000	50,000	50,000
Total Japanese Empire	84,017,000	90,594,000	87,188,000	87,217,000	88,050,000
Russia:					
Central Asia	2,613,000	4,385,000	4,266,000	4,099,000	....
Siberia	5,136,000	4,957,000	6,103,000	4,775,000	....
Transcaucasia	13,000	4,000	13,000	10,000	....
Total Russia (Asiatic) [1]	7,762,000	9,346,000	10,382,000	8,884,000	10,160,000
Total	94,557,000	102,903,000	99,990,000	98,601,000	100,710,000
AFRICA.					
Algeria	47,600,000	41,543,000	31,511,000	50,008,000	48,708,000
Sudan (Anglo-Egyptian)	334,000	300,000	300,000	300,000	300,000
Tunis	7,863,000	9,506,000	5,057,000	9,186,000	6,660,000
Union of South Africa	3,000,000	3,000,000	3,000,000	3,000,000	3,000,000
Total	58,797,000	54,349,000	39,868,000	62,494,000	58,668,000
AUSTRALASIA.					
Australia:					
Queensland	64,000	163,000	67,000	142,000	200,000
New South Wales	115,000	158,000	77,000	172,000	281,000
Victoria	1,095,000	1,295,000	1,093,000	1,706,000	1,056,000
South Australia	522,000	507,000	585,000	852,000	713,000
Western Australia	51,000	50,000	79,000	77,000	105,000
Tasmania	97,000	146,000	154,000	190,000	158,000
Total Australia	1,944,000	2,319,000	2,055,000	3,139,000	2,513,000
New Zealand	1,056,000	1,068,000	1,200,000	2,000,000	1,345,000
Total Australasia	3,000,000	3,387,000	3,255,000	5,139,000	3,858,000
Grand total	1,296,579,000	1,271,601,000	1,265,779,000	1,475,204,000	1,385,245,000

[a] Exclusive of winter barley.

BARLEY—Continued.

Acreage, production, value, prices, exports, etc., of barley in the United States, 1849–1910.

Year.	Acreage sown and harvested.	Average yield per acre.	Production.	Average farm price per bushel Dec. 1.	Farm value Dec. 1.	Chicago cash price per bushel, No. 2. December. Low.	Chicago cash price per bushel, No. 2. December. High.	Chicago cash price per bushel, No. 2. May of following year. Low.	Chicago cash price per bushel, No. 2. May of following year. High.	Domestic exports, fiscal year beginning July 1.	Imports, fiscal year beginning July 1.
	Acres.	*Bush.*	*Bushels.*	*Cents.*	*Dollars.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Bushels.*	*Bushels.*
1849 [a]	....	......	5,167,000	......	....	......	......	......	......	....	....
1859 [a]	....	......	15,826,000	......	....	......	......	......	......	....	....
1866	493,000	22.9	11,284,000	70.2	7,916,000	59	70	85	100	....	3,247,250
1867	1,131,000	22.7	25,727,000	70.1	18,028,000	150	180	227	250	9,810	3,783,966
1868	937,000	24.4	22,896,000	109.0	24,948,000	140	170	149	175	59,077	5,069,880
1869	1,026,000	27.9	28,652,000	70.8	20,298,000	74	85	50	62	255,490	6,727,597
1870	1,109,000	23.7	26,295,000	79.1	20,792,000	68	80	72	95	340,093	4,866,700
1871	1,114,000	24.0	26,718,000	75.8	20,264,000	55½	64	55	71	86,891	5,565,591
1872	1,397,000	19.2	26,846,000	68.6	18,416,000	60	70	71	85	482,410	4,244,751
1873	1,387,000	23.1	32,044,000	86.7	27,794,000	132	158	130	155	320,399	4,891,189
1874	1,581,000	20.6	32,552,000	86.0	27,998,000	120	129½	115	137	91,118	6,255,063
1875	1,790,000	20.6	36,909,000	74.1	27,368,000	81	88	62½	72½	317,781	10,285,957
1876	1,767,000	21.9	38,710,000	63.0	24,403,000	63¾	68½	80	85	1,186,129	6,702,965
1877	1,615,000	21.3	34,441,000	62.8	21,629,000	56¼	64	46½	52½	3,921,501	6,764,228
1878	1,790,000	23.6	42,246,000	57.9	24,454,000	91	100	64	73	715,536	5,720,979
1879	1,681,000	24.0	40,283,000	58.9	23,714,000	86	92	75	80	1,128,923	7,135,258
1880	1,843,000	24.5	45,165,000	66.6	30,091,000	100	120	95	105	885,246	9,528,616
1881	1,968,000	20.9	41,161,000	82.3	33,863,000	101	107	100	100	205,930	12,182,722
1882	2,272,000	21.5	48,954,000	62.9	30,768,000	79	82	80	80	433,005	10,050,687
1883	2,379,000	21.1	50,136,000	58.7	29,420,000	62	67	65	74	724,955	8,596,122
1884	2,609,000	23.5	61,203,000	48.7	29,779,000	53	58	65	65	629,130	9,986,507
1885	2,729,000	21.4	58,360,000	56.3	32,868,000	62	65	58	60	252,183	10,197,115
1886	2,653,000	22.4	59,428,000	53.6	31,841,000	51	54	57	57	1,305,300	10,355,594
1887	2,902,000	19.6	56,812,000	51.9	29,464,000	80	80	69	77	550,884	10,831,461
1888	2,996,000	21.3	63,884,000	59.0	37,672,000	......	......	......	......	1,440,321	11,368,414
1889	3,221,000	24.3	78,333,000	41.6	32,614,000	58	58	......	......	1,408,311	11,332,545
1890	3,135,000	21.4	67,168,000	62.7	42,141,000	......	......	......	......	973,062	5,078,733
1891	3,353,000	25.9	86,839,000	52.4	45,470,000	......	......	......	......	2,800,075	3,146,328
1892	3,400,000	23.6	80,097,000	47.5	38,026,000	65	67	65	65	3,035,267	1,970,129
1893	3,220,000	21.7	69,869,000	41.1	28,729,000	52	54	55	60	5,219,405	791,061
1894	3,171,000	19.4	61,400,000	44.2	27,134,000	53½	55½	51	52	1,563,754	2,116,816
1895	3,300,000	26.4	87,073,000	33.7	29,312,000	(b) 33	40	(b) 25	36	7,680,331	837,384
1896	2,951,000	23.6	69,695,000	32.3	22,491,000	22	37	24½	35	20,030,301	1,271,787
1897	2,719,000	24.5	66,685,000	37.7	25,142,000	25½	42	36	53	11,237,077	124,804
1898	2,583,000	21.6	55,792,000	41.3	23,064,000	40	50½	36	42	2,267,403	110,475
1899	2,878,000	25.5	73,382,000	40.3	29,594,000	35	45	36	44	23,661,662	189,757
1900	2,894,000	20.4	58,926,000	40.9	24,075,000	37	61	37	57	6,293,207	171,004
1901	4,296,000	25.6	109,933,000	45.2	49,705,000	56	63	64	72	8,714,268	57,406
1902	4,661,000	29.0	134,954,000	45.9	61,899,000	36	70	48	56	8,429,141	56,462
1903	4,993,000	26.4	131,861,000	45.6	60,166,000	42	61½	38	59	10,881,627	90,708
1904	5,146,000	27.2	139,749,000	42.0	58,652,000	38	52	40	50	10,661,655	81,020
1905	5,096,000	26.8	136,651,000	40.3	55,047,000	37	53	42	55½	17,729,360	18,049
1906	6,324,000	28.3	178,916,000	41.5	74,236,000	44	56	66	85	8,238,842	38,319
1907	6,448,000	23.8	153,597,000	66.6	102,290,000	78	102	60	75	4,349,078	199,741
1908	6,646,000	25.1	166,756,000	55.4	92,442,000	57	64½	66	75	6,580,393	2,644
1909	7,011,000	24.3	170,284,000	55.2	93,971,000	55	72	50	68	4,311,566	....
1910	7,257,000	22.4	162,227,000	57.8	93,785,000	72	90	......	......	....	....

[a] Census figures.

[b] Prices from 1895 on are for No. 3 grade.

BARLEY—Continued.

Average yield of barley in countries named, bushels per acre, 1890-1909.

Year.	United States.	Russia, European.[a]	Germany.[a]	Austria.[a]	Hungary proper.[a]	France.[b]	United Kingdom.[b]
Average (1890-1899)	23.4	13.3	29.4	21.1	....	22.6	39.8
1900	20.4	11.5	33.4	20.2	23.1	21.8	32.7
1901	25.6	11.2	33.2	22.4	20.0	21.1	32.7
1902	29.0	15.6	35.0	24.6	24.7	24.5	37.0
1903	26.4	15.5	36.3	24.8	25.1	25.2	33.4
1904	27.2	14.4	33.7	22.8	19.7	22.0	32.3
1905	26.8	14.3	33.3	24.0	24.5	23.4	35.9
1906	28.3	13.0	35.2	26.1	26.8	20.8	36.1
1907	23.8	14.2	38.2	27.3	23.1	24.4	36.8
1908	25.1	14.2	34.9	25.2	21.3	22.6	34.9
1909	24.3	17.9	39.5	28.2	25.1	26.2	38.9
Average (1900-1909)	25.8	14.3	35.3	26.3	23.4	23.6	35.0

[a] Bushels of 48 pounds. [b] Winchester bushels.

Acreage, production, and value of barley in the United States in 1910.

State, Territory, or Division.	Acreage.	Production.	Farm value Dec. 1.
	Acres.	*Bushels.*	*Dollars.*
Maine	8,000	248,000	188,000
N. Hampshire	2,000	52,000	40,000
Vermont	15,000	465,000	316,000
New York	78,000	2,207,000	1,545,000
Pennsylvania	9,000	238,000	150,000
N. Atlantic	112,000	3,210,000	2,239,000
Maryland	1,000	31,000	19,000
Virginia	3,000	88,000	59,000
S. Atlantic	4,000	119,000	78,000
Ohio	31,000	884,000	530,000
Indiana	9,000	243,000	136,000
Illinois	30,000	906,000	507,000
Michigan	67,000	1,742,000	1,010,000
Wisconsin	866,000	22,429,000	14,355,000
N. C. E. of Miss. River	1,003,000	26,204,000	16,538,000
Minnesota	1,285,000	26,985,000	16,191,000
Iowa	510,000	15,045,000	8,425,000
Missouri	2,000	54,000	32,000
North Dakota	987,000	5,428,000	2,985,000
South Dakota	1,025,000	18,655,000	10,633,000
Nebraska	135,000	2,498,000	1,124,000
Kansas	300,000	5,400,000	2,430,000
N. C. W. of Miss. River	4,244,000	74,065,000	41,820,000
Kentucky	1,000	24,000	16,000
Tennessee	1,000	23,000	18,000
Texas	5,000	150,000	135,000
Oklahoma	32,000	960,000	518,000
S. Central	39,000	1,157,000	687,000
Montana	52,000	1,456,000	903,000
Wyoming	4,000	120,000	80,000
Colorado	27,000	864,000	518,000
New Mexico	1,000	25,000	20,000
Arizona	34,000	1,224,000	1,102,000
Utah	13,000	468,000	281,000
Nevada	9,000	360,000	252,000
Idaho	65,000	2,145,000	1,072,000
Washington	186,000	5,394,000	3,075,000
Oregon	64,000	2,016,000	1,250,000
California	1,400,000	43,400,000	23,870,000
Far Western	1,855,000	57,472,000	32,423,000
United States	7,257,000	162,227,000	93,785,000

Condition of the barley crop in the United States on the first of months named, 1889-1910.

Year.	June.	July.	August.	When harvested.
	P. ct.	*P. ct.*	*P. ct.*	*P. ct.*
1889	95.6	91.9	90.6	88.9
1890	86.4	88.3	82.8	78.6
1891	90.3	90.9	93.8	94.3
1892	92.1	92.0	91.1	87.4
1893	88.3	88.8	84.6	83.8
1894	82.2	76.8	69.8	71.5
1895	90.3	91.9	87.2	87.6
1896	98.0	88.1	82.9	83.1
1897	87.4	88.5	87.5	86.4
1898	78.8	85.7	79.3	79.2
1899	91.4	92.0	93.6	86.7
1900	86.2	76.3	71.6	70.7
1901	91.0	91.3	86.9	83.8
1902	93.6	93.7	90.2	89.7
1903	91.5	86.8	83.4	82.1
1904	90.5	88.5	88.1	87.4
1905	93.7	91.5	89.5	87.8
1906	93.5	92.5	90.3	89.4
1907	84.9	84.4	84.5	78.5
1908	89.7	86.2	83.1	81.2
1909	90.6	90.2	85.4	80.5
1910	89.6	73.7	70.0	69.8

BARLEY—Continued.

Average farm price of barley per bushel, on the first of each month, 1909–10.

Month.	United States.		North Atlantic States.		South Atlantic States.		N. Cen. States East of Miss. R.		N. Cen. States West of Miss. R.		South Central States.		Far Western States.	
	1910.	1909.	1910.	1909.	1910.	1909.	1910.	1909.	1910.	1909.	1910.	1909.	1910.	1909.
	Cts.	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*
January	57.6	56.5	71.7	70.6	70.0	69.3	59.4	59.6	49.6	49.2	69.2	64.5	70.7	71.4
February	59.3	58.3	73.3	71.4	67.0	70.2	63.8	60.6	51.9	50.5	75.0	55.0	69.7	75.3
March	60.2	59.4	73.7	72.8	69.0	70.2	63.1	60.9	52.7	52.7	66.4	60.4	71.7	74.2
April	59.7	61.2	77.8	79.5	69.0	72.8	63.1	62.1	51.3	54.9	63.0	68.8	72.6	74.6
May	56.5	63.8	77.1	80.1	72.0	71.9	60.2	64.8	47.9	56.2	69.8	84.9	69.1	80.7
June	55.7	67.0	80.8	85.1	65.0	76.0	61.3	70.3	47.7	59.8	61.5	64.1	66.1	81.5
July	53.9	67.0	74.8	83.1	69.0	74.5	60.4	68.7	48.8	59.9	60.6	67.3	58.5	82.0
August	54.7	61.2	77.2	82.0	69.0	70.9	62.2	66.1	51.1	53.8	49.0	50.5	55.8	74.6
September	57.2	54.6	73.7	75.0	70.0	72.0	62.9	58.5	54.2	45.2	54.9	71.1	58.7	73.4
October	56.1	53.4	71.7	74.0	68.0	75.0	61.5	57.6	54.0	44.8	58.6	66.3	55.9	70.2
November	55.3	53.3	70.3	72.0	67.0	71.0	61.0	58.4	53.6	45.0	60.6	71.1	54.0	68.6
December	57.8	55.2	69.8	71.0	65.5	68.6	63.1	56.4	56.5	45.7	59.4	69.0	56.4	71.1

Average yield per acre of barley in the United States.

State, Territory, or Division.	10-year averages. 1866–1875.	1876–1885.	1886–1895.	1896–1905.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	1909.	1910.
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*
Maine	19.8	21.2	24.2	28.8	27.5	29.4	29.9	32.7	29.0	31.5	28.0	28.0	28.5	31.0
New Hampshire	24.8	21.8	23.4	22.7	21.5	21.2	19.8	20.7	20.8	21.4	24.0	24.0	25.0	26.0
Vermont	24.8	25.4	26.0	31.2	29.6	29.7	29.2	33.1	31.5	32.8	28.5	33.0	30.0	31.0
New York	22.0	23.0	21.0	24.1	14.0	28.5	26.6	26.8	25.7	26.3	25.0	26.0	24.8	28.3
Pennsylvania	21.5	22.3	19.6	20.8	17.2	21.0	21.3	22.6	25.0	25.0	25.5	26.0	21.8	26.5
North Atlantic	21.9	23.0	21.3	24.8	16.3	28.1	26.6	27.4	27.2	27.2	25.7	27.0	25.5	28.7
Maryland	20.9	.....	22.6	24.7	18.0	27.0	25.9	21.8	31.0	31.0	33.0	30.0	32.0	31.0
Virginia	16.3	15.7	18.4	24.1	24.9	18.3	24.4	24.7	28.0	28.6	29.0	28.0	28.5	29.3
South Atlantic	17.0	14.7	19.4	24.2	22.5	21.5	25.0	23.7	29.1	29.5	30.3	28.5	29.5	29.8
Ohio	22.8	22.7	24.7	26.7	24.9	32.3	23.3	27.5	26.2	30.0	28.0	27.5	25.9	28.5
Indiana	21.9	22.7	20.9	24.6	25.4	28.0	22.8	29.2	28.0	29.4	20.5	23.0	23.5	27.0
Illinois	23.1	21.2	22.2	26.9	24.5	28.6	28.2	27.1	30.0	30.0	28.0	28.5	28.0	30.2
Michigan	22.1	24.0	21.5	24.5	22.8	28.6	25.2	24.1	27.0	26.1	22.0	25.5	24.7	26.0
Wisconsin	26.4	24.5	25.2	28.9	27.2	33.8	27.7	30.0	29.9	30.7	23.0	30.0	28.0	25.9
N. Central E. of Miss. R.	23.6	23.6	24.4	28.5	26.7	33.1	27.2	29.4	29.6	30.3	23.1	29.5	27.7	26.1
Minnesota	25.5	25.9	24.5	26.4	25.8	28.6	25.3	28.4	27.0	28.0	22.5	25.0	23.6	21.0
Iowa	25.2	22.6	22.6	25.6	23.6	26.3	23.4	27.8	26.0	28.3	25.5	27.0	22.0	29.5
Missouri	22.9	19.7	20.8	19.8	16.5	25.0	18.3	20.3	23.0	24.2	23.0	23.0	25.0	27.0
North Dakota	.....	.....	22.0	23.5	28.2	31.6	21.6	28.1	28.0	25.8	18.3	19.5	21.0	5.5
South Dakota	.....	.....	17.2	25.0	22.4	29.2	31.4	28.0	30.0	29.0	23.0	26.5	19.5	18.2
Nebraska	27.8	20.1	19.7	24.1	16.0	31.1	26.6	27.4	27.5	28.0	20.8	23.5	22.0	18.5
Kansas	24.5	19.2	18.6	19.6	15.9	16.0	31.9	21.6	22.0	23.5	12.0	16.0	18.0	18.0
N. Central W. of Miss. R.	25.3	22.6	22.4	25.2	24.1	28.2	25.3	27.8	27.2	27.4	21.1	23.7	21.4	17.5
Kentucky	19.6	22.3	24.0	21.2	19.4	25.9	21.4	20.6	24.0	26.0	25.0	25.0	24.0	24.0
Tennessee	19.5	14.9	15.8	17.3	16.8	16.0	20.6	22.0	21.6	23.0	20.0	25.0	24.0	23.0
Texas	25.1	20.3	15.4	21.4	13.5	21.3	24.4	31.0	24.0	24.5	17.0	24.0	19.4	30.0
Oklahoma	.....	.....	.....	28.2	22.0	36.0	26.9	30.1	26.0	29.8	18.7	23.0	23.0	30.0
South Central	20.0	20.8	19.5	25.8	19.6	31.4	25.7	29.5	25.2	28.3	18.7	23.2	22.7	29.7
Montana	.....	29.9	27.3	35.2	39.0	37.0	40.2	29.9	33.0	33.0	38.0	35.0	38.0	28.0
Wyoming	.....	.....	.....	28.0	32.5	24.4	21.3	30.1	31.7	31.4	32.0	35.0	31.0	30.0
Colorado	.....	22.6	26.9	29.5	28.7	26.3	38.3	37.1	33.0	41.0	40.0	33.0	36.0	32.0
New Mexico	.....	19.6	22.1	26.2	31.7	16.1	23.1	23.6	21.0	27.0	26.0	42.0	40.0	25.0
Arizona	.....	19.2	22.2	32.9	28.7	25.2	32.8	33.6	44.0	42.2	35.5	38.0	40.0	36.0
Utah	.....	22.3	26.5	34.4	35.0	32.1	37.5	38.3	37.0	44.0	39.0	45.0	40.0	36.0
Nevada	27.5	22.5	26.8	34.4	33.0	34.3	34.6	35.9	34.0	36.8	40.0	30.0	38.0	40.0
Idaho	.....	28.2	26.5	35.1	40.2	46.3	34.4	37.4	40.0	41.0	44.5	41.0	40.0	33.0
Washington	.....	30.4	30.3	37.9	43.5	43.7	37.9	34.8	40.0	36.5	40.5	30.5	39.5	29.0
Oregon	29.1	27.0	25.7	29.6	30.6	31.9	33.2	28.7	31.0	35.0	42.0	29.0	31.5	31.5
California	23.4	20.6	21.2	22.0	26.0	26.0	25.7	22.7	21.5	27.2	28.9	23.5	26.5	31.0
Far Western	23.7	21.2	22.1	24.8	28.6	28.7	28.0	25.1	25.2	29.1	31.9	26.1	29.6	31.0
United States	22.9	22.4	22.6	25.1	25.6	29.0	26.4	27.2	26.8	28.3	23.8	25.1	24.3	22.4

BARLEY—Continued.

Average farm value per acre of barley in the United States December 1.

State, Territory, or Division.	10-year averages.				1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	1909.	1910.
	1866–1875.	1876–1885.	1886–1895.	1896–1905.										
	Dolls.	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*
Maine	16.24	16.11	16.21	17.86	18.43	19.99	21.23	23.22	19.72	20.48	21.88	22.62	22.00	23.50
N. Hampshire	22.32	16.79	16.15	15.66	17.20	15.90	16.63	15.53	15.18	13.70	19.00	19.00	20.00	20.00
Vermont	23.06	19.81	16.38	16.85	19.54	18.12	17.52	21.85	21.18	20.34	21.36	23.07	23.07	21.07
New York	19.58	17.25	14.07	12.29	7.84	15.68	14.63	15.28	13.88	14.47	20.00	18.19	17.12	19.81
Pennsylvania	19.14	17.62	11.37	10.40	10.15	11.34	11.93	12.66	13.75	13.75	17.89	16.33	14.56	16.67
N. Atlantic	19.43	17.34	14.14	12.97	9.66	15.88	15.15	16.27	15.04	15.44	20.15	19.01	18.12	19.99
Maryland	16.72	20.90	11.75	13.09	9.36	13.23	12.95	13.95	14.88	14.57	20.00	20.00	20.00	19.00
Virginia	11.74	12.72	11.04	13.26	11.70	9.88	13.91	15.07	15.40	16.02	18.00	19.33	20.33	19.67
S. Atlantic	15.38	13.38	11.31	13.12	10.87	11.12	13.55	14.66	15.21	15.47	18.57	19.49	20.25	19.50
Ohio	19.15	16.57	13.83	12.28	12.70	15.83	11.65	14.30	11.79	13.80	19.61	17.60	15.81	17.10
Indiana	18.40	16.80	11.29	11.07	12.95	12.88	11.40	14.02	12.00	15.29	13.78	15.00	14.89	15.11
Illinois	16.17	13.14	11.32	11.57	12.99	12.58	12.41	11.65	12.60	12.60	16.08	18.53	14.55	16.90
Michigan	18.78	16.56	12.04	11.76	12.31	14.87	13.10	13.25	12.69	12.79	14.74	15.81	15.07	15.07
Wisconsin	19.80	14.21	12.35	11.85	13.87	15.55	13.30	12.90	12.26	13.82	17.25	17.40	15.68	16.58
N. C. E. of Miss. River	18.20	14.92	12.30	11.88	13.66	15.36	13.13	12.96	12.28	13.71	17.09	17.32	15.60	16.49
Minnesota	15.56	12.43	10.29	8.71	11.61	10.58	9.36	9.09	8.64	9 80	15.08	12.25	11.09	12.60
Iowa	14.87	10.17	9.27	8.45	11.09	9.47	8.42	10.01	7.80	9.90	15.30	13.77	10.12	16.52
Missouri	19.46	13.00	10.19	9.11	9 08	13.75	9.88	12.59	10.12	11.62	13.00	14.50	17.00	16.00
N. Dakota	......	......	7.92	7.52	11.28	11.38	7.78	7.87	8.40	8.51	10.61	8.97	9.03	3.02
S. Dakota	......	......	6.19	7.50	9.41	11.10	10.36	8.96	8.70	9.28	14.03	12.45	8.78	10.37
Nebraska	17.24	7.44	7.49	7.23	6.56	10.26	8.78	8.49	8.52	8.68	10.40	10.81	9.46	8.33
Kansas	15.92	8.45	7.81	6.27	7.15	6.08	10.85	7.99	7.04	7.76	6.48	8.64	9.54	8.10
N. C. W. of Miss. River	15.66	10.10	9.12	8.16	10.68	10.31	9.04	8.89	8.36	9.24	12.98	11.45	9.80	9.85
Kentucky	18.03	16.50	12.48	11.02	13.77	14.50	13.48	13.39	10.56	14.30	19.00	18.00	18.00	16.00
Tennessee	16.38	11.18	9.16	10.38	11.76	9.76	13.39	14.08	12.31	13.80	14.00	18.00	19.00	18.00
Texas	24.60	14.82	9.70	13.91	11.88	15.34	17.08	22.63	15.84	14.95	12.50	18.75	19.50	27.00
Oklahoma	......	......	......	12.13	10.78	15.12	11.84	12.04	10.40	9.83	9.34	13.33	14.93	16.19
S. Central	18.38	15.43	10.82	12.31	11.23	14.80	13.15	14.58	11.72	11.23	9.99	14.18	15.64	17.62
Montana	......	23.32	15.83	19.01	22.23	18.87	23.32	18.54	18.48	18.48	23.53	21.56	23.94	17.37
Wyoming	......	......	......	18.48	21.12	18.30	15.34	17.16	18.70	20.10	21.75	22.75	23.00	20.00
Colorado	......	18.53	16.41	15.93	18.08	15.78	23.36	21.15	17.49	22.14	24.00	21.46	23.77	19.19
New Mexico	......	16.46	14.14	17.29	20.61	11.43	14.78	21.24	14.49	17.01	18.00	33.00	40.00	20.00
Arizona	......	14.59	14.43	26.65	19.52	22.93	23.62	31.25	35.64	32.07	27.69	32.31	35.19	32.41
Utah	......	13.83	14.04	17.89	18.55	18.94	22.13	21.83	19.61	23.76	22.64	24.33	26.38	21.62
Nevada	35.48	20.25	17.15	25.80	23.10	27.44	29.41	25.85	23.80	25.39	33.14	23.12	28.50	28.00
Idaho	......	21.15	14.04	16.85	21.31	24.54	17.89	23.56	19.20	20.50	25.82	21.73	23.60	16.49
Washington	......	17.02	15.15	16.68	17.83	20.10	18.95	17.05	18.80	17.89	23.49	17.69	25.28	16.53
Oregon	18.62	16.47	12.34	14.80	14.99	16.59	19.59	16.93	16.12	18.20	23.93	17.11	20.78	19.53
California	20.83	14.01	11.24	11.88	10.66	16.38	15.68	13.62	12.68	14.69	22.54	17.39	19.61	17.05
Far Western	21.26	14.46	11.74	13.17	12.27	17.11	16.61	14.81	14.14	15.61	22.97	18.14	21.07	17.48
United States	18.09	13.84	11.03	10.34	11.57	13.28	12.05	11.40	10.80	11.74	15.86	13.91	13.40	12.92

BARLEY—Continued.

Average farm price of barley per bushel in the United States.

State, Territory, or Division.	Price December 1, by decades.				Price December 1, by years.									Price bimonthly, 1910.					
	1866-1875.	1876-1885.	1886-1895.	1896-1905.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	1909.	Feb. 1.	Apr. 1.	June 1.	Aug. 1.	Oct. 1.	Dec. 1.
	Cts.	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*
Me	82	76	67	62	67	68	71	71	68	65	78	81	77	84	95	104	92	85	76
N. H	90	77	69	69	80	75	84	75	73	64	80	80	80	80	83	85	102	88	77
Vt	93	78	63	54	66	61	60	66	54	62	75	70	77	78	90	88	84	75	68
N. Y	89	75	67	51	56	55	55	57	54	55	80	70	69	71	73	77	73	69	70
Pa	89	79	58	50	59	54	56	56	55	55	70	63	67	70	73	74	73	68	63
N. Atlantic	88.7	75.4	66.4	52.3	59.1	56.5	56.9	59.3	55.2	56.8	78.4	70.4	71.0	73.3	77.8	80.8	77.2	71.7	69.8
Md	80	81	52	53	52	49	50	64	48	47	60	65	64	....	58	60	....	....	61
Va	72	81	60	55	47	54	57	61	55	56	62	69	71	67	69	65	69	68	67
S. Atlantic	90.5	91.0	58.3	54.2	48.4	51.7	54.3	62.0	52.3	52.5	61.3	68.4	68.6	67.0	69.0	65.0	69.0	68.0	65.5
Ohio	84	73	56	46	51	49	50	52	45	46	70	64	61	65	67	66	58	58	60
Ind	84	74	54	45	51	46	50	48	45	52	67	65	63	59	65	60	64	57	56
Ill	70	62	51	43	53	44	44	43	42	42	67	65	52	56	57	54	58	56	56
Mich	85	69	56	48	54	52	52	55	47	49	67	62	61	65	65	67	69	60	58
Wis	75	58	49	41	51	46	48	43	41	45	75	58	56	64	63	61	62	62	64
N. C. E. of Miss. Riv	77.1	63.2	50.4	41.7	51.2	46.4	48.2	44.1	41.6	45.3	74.0	58.7	56.4	63.8	63.1	61.3	62.2	61.5	63.1
Minn	61	48	42	33	45	37	37	32	32	35	67	49	47	54	53	49	53	57	60
Iowa	59	45	41	33	47	36	36	36	30	35	60	51	46	53	52	49	50	52	56
Mo	85	66	49	46	55	55	54	62	44	48	57	63	68	70	69	79	63	60	60
N. Dak	....	....	36	32	40	36	36	28	30	33	58	46	43	48	48	43	51	52	55
S. Dak	....	....	36	30	42	38	33	32	29	32	61	47	45	52	50	47	50	55	57
Nebr	62	37	38	30	41	33	33	31	31	31	50	46	43	47	47	47	45	42	45
Kans	65	44	42	32	45	38	34	37	32	33	54	54	53	55	59	58	49	49	45
N. C. W. of Miss. Riv	61.9	44.7	40.7	32.4	44.3	36.6	35.7	32.0	30.8	33.0	61.5	48.3	45.7	51.9	51.3	47.7	51.1	54.0	56.5
Ky	92	74	52	52	71	56	63	65	44	55	75	72	76	....	75	65	52	67	65
Tenn	84	75	58	60	70	61	65	64	57	60	70	73	79	79	85	81	70	81	80
Tex	98	73	63	65	88	72	70	73	66	61	73	78	100	....	91	100	98	91	90
Okla	....	....	....	43	49	42	44	40	40	33	50	58	65	75	59	56	42	54	54
S. Central	91.9	74.2	55.5	47.7	57.2	47.2	51.1	49.4	46.4	39.7	53.4	61.1	69.0	75.0	63.0	61.5	49.0	58.6	59.4
Mont	....	78	58	54	57	51	58	62	56	56	62	61	63	70	75	70	75	63	62
Wyo	....	....	....	66	65	75	72	57	59	64	68	65	74	69	70	78	83	65	67
Colo	....	82	61	54	63	60	61	57	53	54	60	65	66	64	72	79	75	61	60
N. Mex	....	84	64	66	65	71	64	90	69	63	70	79	100	100	99	76	67	74	80
Ariz	....	76	65	81	68	91	72	93	81	76	78	85	88	105	105	91	68	89	90
Utah	...	62	53	52	53	59	59	57	53	54	58	54	66	70	74	70	67	60	60
Nev	129	90	64	75	70	80	85	72	70	69	83	77	75	80	100	98	85	70	70
Idaho	....	75	53	48	53	53	52	63	48	50	58	53	59	72	63	69	51	58	50
Wash	....	56	50	44	41	46	50	49	47	49	58	58	64	65	67	63	54	57	57
Oreg	64	61	48	50	49	52	59	59	52	52	57	59	66	72	72	75	69	60	62
Cal	89	68	53	54	41	63	61	60	59	54	78	74	74	69	73	64	53	53	55
Far West	89.7	68.2	53.1	53.1	42.9	59.7	59.3	58.9	56.2	53.6	72.0	69.5	71.1	69.7	72.6	66.1	55.8	55.9	56.4
United States	79.0	61.8	48.8	41.2	45.2	45.9	45.6	42.0	40.3	41.5	66.6	55.4	55.2	59.3	59.7	55.7	54.7	56.1	57.8

BARLEY—Continued.

Wholesale prices of barley per bushel, 1897–1910.

Date.	Cincinnati.		Chicago.		St. Louis.		Milwaukee.		San Francisco.	
	Extra No. 3 spring.		No. 3.		Malting, medium to choice.		Extra No. 3.		No. 1 brewing (per 100 lbs.)	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*		
1897	30	45	22	47	......	......	......	......	$0.82½	$1.12½
1898	32	54	26½	53	......	......	......	......	.92½	1.42½
1899	44	56	34	54	......	......	......	......	.85	1.47½
1900	44¾	66	34	62	......	......	......	......	.67½	.75
1901	58	70	36	65	50	67	......	......	.73¾	.85
1902	55	74	35	73	48	70	......	......	.80	1.32½
1903	55	71	42	63	48	67	48	63	.90	1.22½
1904	55	69	35	61	42	65	41	61	*a* .95	*a* 1.15
1905	52	58	36½	55	43	56	41	54	*a* 1.02½	*a* 1.35
1906	52	62	38	58	36	58½	43½	56	......	......
1907.										
January	54	60	45	57	50	59	49	57	1.15	1.20
February	57	68	48	63	55	67	52½	65	1.12½	1.20
March	67	71	57	75	63	75	63½	74½	1.15	1.27½
April	69	77	60	74	70	73	66	74½	1.20	1.27½
May	74	92	66	85	80	80	70	85	1.25	1.30
June	90	92	66	76	66	66	68½	79	1.22½	1.27½
July	90	92	55	75	65	65	62	70	1.22½	1.32½
August	88	92	55	87	......	......	63½	87	1.30	1.37½
September	88	113	76	100	88	100	83	108	1.37½	1.55
October	108	113	70	110	80	115	72	111	1.45	1.72½
November	108	113	58	95	71	95	80	100	1.62½	1.72½
December	108	113	78	102	84	102	85	100	1.60	1.67½
Year	54	113	45	110	50	115	49	111	1.12½	1.72½
1908.			Low malting to fancy.						No. 1 feed.	
January	113	115	78	106	84	98	85	105	1.35	1.57½
February	102	115	80	95	82	92	78	95	1.25	1.42½
March	102	110	72	93	......	......	75	90	1.25	1.42½
April	98	110	65	87	......	......	68	86	1.32½	1.42½
May	......	......	60	75	......	......	64	71	1.37½	1.50
June	......	......	49	66	......	......	50	66	1.22½	1.42½
July	......	......	57	74	......	......	60	61	1.25	1.40
August	68	70	60	68	......	......	59	67	1.25	1.38¾
September	67	73	56	67	......	......	56	65½	1.25	1.36¼
October	67	71	53	62	......	......	57	66	1.32½	1.42½
November	67	71	54½	67	60	65	58	66½	1.40	1.47½
December	67	69	57	64½	......	......	59	65¼	1.40	1.45
Year	67	115	49	106	60	98	50	105	1.22½	1.57½
1909.										
January	67	70	59	66	60	68	62	66	1.36¼	1.43¾
February	70	71	60½	66½	......	......	62	66½	1.37½	1.42½
March	71	72	63	68	......	......	63	67½	1.40	1.50
April	71	72	62	68	......	......	63½	68	1.47½	1.65
May	73	74	66	75	......	......	60	77	1.55	1.70
June	74	84	70	82½	......	......	65	82½	1.40	1.60
July	75	76	62	78	64	70	64½	72	1.42½	1.48¾
August	......	......	50	70	64	70	54	68	1.35	1.45
September	64	68	50	66	64	70	59	68	1.35	1.40
October	64	67	50	66	50	70	55	67	1.35	1.45
November	66	68	53	67½	58	71	60	67	1.43¾	1.47½
December	70	76	55	72	58	74	64	70	1.45	1.52½
Year	64	84	50	82½	50	74	54	82½	1.35	1.70
1910.							(*b*)			
January	76	80	63	74	65	75	68	73	1.32½	1.50
February	73	80	64	73	70	75	67½	71½	1.35	1.40
March	69	78	56	73	69	75	65	72	1.35	1.45
April	67	74	50	70	......	......	59	72	1.10	1.35
May	67	72	50	68	......	......	60	67	1.06¾	1.15
June	70	72	52	69	......	......	61	67	1.00	1.10
July	70	80	50	77	......	......	62	75	1.00	1 10
August	75	80	54	75	......	......	62	75	.95	1.08¾
September	72	81	60	75	......	......	67	74	.97½	1.06¼
October	74	82	63	77	......	......	68½	76	.95	1.02½
November	80	86	66	83½	......	......	71½	82	.95	1.03¾
December	72	86	72	90	......	......	76	90	1.02½	1.11¼
Year	67	86	50	90	65	75	59	90	.95	1.50

a No. 1 feed.

b Medium No. 3 from May to December, inclusive.

RYE.

Rye area of countries named, 1906–1910.

Country.	1906.	1907.	1908.	1909.	1910.
NORTH AMERICA.	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*
United States	2,001,900	1,926,000	1,948,000	2,006,000	2,028,000
Canada:					
Ontario	79,900	67,200	63,400	57,300	52,500
Manitoba	4,200	6,000	6,300	4,700	3,800
Other	(a)	(a)	30,600	29,300	27,800
Total Canada	....	....	100,300	91,300	84,100
Mexico	(a)	(a)	(a)	(a)	(a)
EUROPE.					
Austria-Hungary:					
Austria	4,992,800	4,580,300	5,139,100	5,134,700	5,092,700
Hungary proper	2,624,800	2,460,900	2,575,000	2,485,700	2,624,400
Croatia-Slavonia	175,700	171,500	175,100	172,100	164,000
Bosnia-Herzegovina	41,900	37,700	31,100	28,200	30,900
Total Austria-Hungary	7,835,200	7,250,400	7,920,300	7,820,700	7,912,000
Belgium	624,900	641,800	637,900	(a)	(a)
Bulgaria	461,700	450,800	429,300	498,000	556,000
Denmark	680,700	682,000	682,000	677,100	679,500
Finland	(a)	(a)	(a)	(a)	(a)
France	3,095,100	3,064,300	3,074,800	3,031,900	3,061,200
Germany	15,077,200	14,931,500	15,122,600	15,149,300	15,287,500
Italy	(a)	(a)	(a)	300,700	300,800
Netherlands	539,200	544,600	548,800	553,400	545,800
Norway	(a)	37,100	37,100	37,200	37,200
Roumania	454,500	362,400	363,400	337,500	429,600
Russia:					
Russia proper	66,638,400	65,681,900	63,009,500	63,800,500	....
Poland	5,180,600	5,238,000	5,130,100	5,204,400	....
Northern Caucasia	735,000	683,200	553,300	585,500	....
Total Russia (European)	72,554,000	71,603,100	68,692,900	69,590,400	68,817,000
Servia	120,200	109,800	117,800	113,700	102,900
Spain	2,190,700	2,228,100	2,246,800	2,058,600	2,029,700
Sweden	1,015,300	1,005,900	999,500	998,300	963,700
United Kingdom	75,200	70,100	60,800	63,000	(a)
ASIA.					
Russia:					
Central Asia	35,000	65,200	54,200	189,500	....
Siberia	2,395,300	2,609,100	2,265,400	2,201,600	....
Transcaucasia	1,200	1,200	1,100	1,600	....
Total Russia (Asiatic)	2,431,500	2,675,500	2,320,700	2,392,700	2,232,400
AUSTRALASIA.					
Australia:					
Queensland	100	100	100	100	200
New South Wales	4,400	6,700	5,300	4,700	5,400
Victoria	2,000	1,600	1,400	2,000	(a)
Western Australia	500	600	600	600	1,100
Tasmania	500	700	700	700	1,100
New Zealand	1,400	1,300	3,000	3,500	(a)
Total Australasia	8,900	11,000	11,100	11,600	....

a No official statistics of area; estimates of production on p. 542.

RYE—Continued.

Rye crop of countries named, 1906–1910.

Country.	1906.	1907.	1908.	1909.	1910.
NORTH AMERICA.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
United States	33,375,000	31,566,000	31,851,000	32,239,000	33,039,000
Canada:					
Ontario	1,327,000	1,039,000	1,030,000	1,097,000	923,000
Manitoba	101,000	84,000	101,000	75,000	93,000
Other	500,000	371,000	580,000	543,000	528,000
Total Canada	1,928,000	1,494,000	1,711,000	1,715,000	1,544,000
Mexico	70,000	70,000	70,000	70,000	70,000
Total	35,373,000	33,130,000	33,632,000	34,024,000	34,653,000
EUROPE.					
Austria-Hungary:					
Austria	99,246,000	86,452,000	113,309,000	114,433,000	108,939,000
Hungary proper	51,962,000	39,445,000	45,185,000	44,858,000	54,721,000
Croatia-Slavonia	1,918,000	2,136,000	2,520,000	2,393,000	2,318,000
Bosnia-Herzegovina	388,000	271,000	298,000	368,000	394,000
Total Austria-Hungary	153,514,000	128,304,000	161,312,000	162,052,000	166,372,000
Belgium	20,569,000	23,484,000	22,199,000	22,000,000	21,000,000
Bulgaria	7,538,000	3,883,000	5,604,000	6,906,000	11,724,000
Denmark	18,828,000	15,893,000	19,170,000	18,922,000	19,740,000
Finland	11,927,000	11,032,000	12,000,000	11,000,000	8,982,000
France	50,429,000	55,896,000	51,703,000	54,934,000	48,212,000
Germany	378,948,000	384,150,000	422,692,000	446,767,000	413,802,000
Italy	5,000,000	5,000,000	5,000,000	5,032,000	5,439,000
Netherlands	13,938,000	14,483,000	15,866,000	17,652,000	14,817,000
Norway	963,000	823,000	869,000	1,011,000	896,000
Roumania	8,900,000	2,554,000	2,640,000	3,090,000	7,885,000
Russia:					
Russia proper	555,698,000	693,257,000	673,736,000	783,055,000	....
Poland	74,100,000	74,127,000	77,954,000	86,775,000	....
Northern Caucasia	8,877,000	6,807,000	6,993,000	7,335,000	....
Total Russia (European)	638,675,000	774,191,000	758,683,000	877,165,000	843,699,000
Servia	1,560,000	911,000	974,000	1,024,000	768,000
Spain	30,918,000	27,027,000	26,412,000	34,901,000	27,596,000
Sweden	25,915,000	22,001,000	26,052,000	25,728,000	24,154,000
United Kingdom	2,073,000	1,895,000	1,776,000	1,954,000	2,000,000
Total	1,369,695,000	1,471,527,000	1,532,952,000	1,690,138,000	1,617,086,000
ASIA.					
Russia:					
Central Asia	404,000	993,000	564,000	1,498,000	....
Siberia	27,752,000	32,931,000	22,775,000	18,152,000	....
Transcaucasia	13,000	12,000	9,000	18,000	....
Total Russia (Asiatic)	28,169,000	33,936,000	23,348,000	19,668,000	23,927,000
AUSTRALASIA.					
Australia:					
Queensland	1,000	3,000	1,000	1,000	3,000
New South Wales	50,000	98,000	56,000	51,000	66,000
Victoria	30,000	21,000	22,000	33,000	35,000
Western Australia	4,000	5,000	5,000	4,000	10,000
Tasmania	8,000	15,000	15,000	18,000	18,000
Total Australia	93,000	142,000	99,000	107,000	132,000
New Zealand	65,000	43,000	73,000	94,000	100,000
Total Australasia	158,000	185,000	172,000	201,000	232,000
Grand total	1,433,395,000	1,538,778,000	1,590,104,000	1,744,031,000	1,675,898,000

RYE—Continued.

Acreage, production, value, prices, and exports of rye in the United States, 1849–1910.

Year.	Acreage.	Average yield per acre.	Production.	Average farm price per bushel Dec. 1.	Farm value Dec. 1.	Chicago cash price per bushel, No. 2. December. Low.	December. High.	May of following year. Low.	May of following year. High.	Domestic exports, including rye flour, fiscal year beginning July 1.
	Acres.	*Bush.*	*Bushels.*	*Cents.*	*Dollars.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Bushels.*
1849 [a]	....	....	14,189,000	....	....	......	......	......	......	....
1859 [a]	....	....	21,101,000	....	....	......	......	......	......	....
1866	1,548,000	13.5	20,865,000	82.2	17,150,000	......	......	142	150	234,971
1867	1,689,000	13.7	23,184,000	100.4	23,281,000	132	157	173	185	564 901
1868	1,651,000	13.6	22,505,000	94.9	21,349,000	106½	118	100	115½	92,869
1869	1,658,000	13.6	22,528,000	77.0	17,342,000	66	77½	78	83½	199,450
1870	1,176,000	13.2	15,474,000	73.2	11,327,000	67	74	81	91	87,174
1871	1,070,000	14.4	15,366,000	71.1	10,928,000	62	63¾	75	93	832,689
1872	1,049,000	14.2	14,889,000	67.6	10,071,000	57½	70	68½	70	611,749
1873	1,150,000	13.2	15,142,000	70.3	10,638,000	70	81	91	102	1,923,404
1874	1,117,000	13.4	14,991,000	77.4	11,610,000	93	99½	103	107½	267,058
1875	1,360,000	13.0	17,722,000	67.1	11,894,000	67	68¾	61½	70½	589,159
1876	1,468,000	13.9	20,375,000	61.4	12,505,000	65½	73	70	92½	2,234,856
1877	1,413,000	15.0	21,170,000	57.6	12,202,000	55½	56½	54	60	4,249,684
1878	1,623,000	15.9	25,843,000	52.5	13,566,000	44	44½	47	52	4,877,821
1879	1,625,000	14.5	23,639,000	65.6	15,507,000	73½	81	73½	85	2,943,894
1880	1,768,000	13.9	24,541,000	75.6	18,565,000	82	91½	115	118	1,955,155
1881	1,789,000	11.6	20,705,000	93.3	19,327,000	96½	98	77	83	1,003,609
1882	2,228,000	13.4	29,960,000	61.5	18,439,000	57	58½	62	67	2,206,212
1883	2,315,000	12.1	28,059,000	58.1	16,301,000	56½	60	60½	62½	6,247,590
1884	2,344,000	12.2	28,640,000	51.9	14,857,000	51	52	68	73	2,974,390
1885	2,129,000	10.2	21,756,000	57.9	12,595,000	58½	61	58	61	216,699
1886	2,130,000	11.5	24,489,000	53.8	13,181,000	53	54½	54½	56½	377,302
1887	2,053,000	10.1	20,693,000	54.5	11,283,000	55½	61½	63	68	94,827
1888	2,365,000	12.0	28,415,000	58.8	16,722,000	50	52	39	41½	309,266
1889	2,171,000	13.1	28,420,000	42.3	12,010,000	44	45½	49½	54	2,280,975
1890	2,142,000	12.0	25,807,000	62.9	16,230,000	64½	68½	83	92	358,263
1891	2,176,000	14.6	31,752,000	77.4	24,589,000	86	92	70¼	79	12,068,628
1892	2,164,000	12.9	27,979,000	54.2	15,160,000	46	51	50½	62	1,493,924
1893	2,038,000	13.0	26,555,000	51.3	13,612,000	45	47½	44½	48	249,152
1894	1,945,000	13.7	26,728,000	50.1	13,395,000	47½	49	62½	67	32,045
1895	1,890,000	14.4	27,210,000	44.0	11,965,000	32	35¾	33	36½	1,011,128
1896	1,831,000	13.3	24,369,000	40.9	9,961,000	37	42½	32¾	35½	8,575,663
1897	1,704,000	16.1	27,363,000	44.7	12,240,000	45¾	47	48	75	15,562,035
1898	1,643,000	15.6	25,658,000	46.3	11,875,000	52½	55½	56½	62	10,169,822
1899	1,659,000	14.4	23,962,000	51.0	12,214,000	49	52	53	56¼	2,382,012
1900	1,591,000	15.1	23,996,000	51.2	12,295,000	45¾	49¾	51½	54	2,345,512
1901	1,988,000	15.3	30,345,000	55.7	16,910,000	59	65¾	54½	58	2,712,077
1902	1,979,000	17.0	33,631,000	50.8	17,081,000	48	49¾	48	50½	5,445,273
1903	1,907,000	15.4	29,363,000	54.5	15,994,000	50½	52½	69¾	78	784,068
1904	1,793,000	15.2	27,242,000	68.8	18,748,000	73	75	70	84	29,749
1905	1,730,000	16.5	28,486,000	61.1	17,414,000	64	68	58	62	1,387,826
1906	2,002,000	16.7	33,375,000	58.9	19,671,000	61	65	69	87½	769,717
1907	1,926,000	16.4	31,566,000	73.1	23,068,000	75	82	79	86	2,444,588
1908	1,948,000	16.4	31,851,000	73.6	23,455,000	75	77¼	83	90	1,295,701
1909	2,006,000	16.1	32,239,000	73.9	23,809,000	72	80	74	80	242,262
1910	2,028,000	16.3	33,039,000	72.2	23,840,000	80	81½	......	......	....

[a] Census figures.

RYE—Continued.

Acreage, production, and value of rye in the United States in 1910.

State, Territory, or Division.	Acreage.	Production.	Farm value Dec. 1.
	Acres.	*Bushels.*	*Dollars.*
Vermont	2,000	35,000	30,000
Massachusetts	5,000	85,000	80,000
Connecticut	10,000	200,000	172,000
New York	170,000	3,111,000	2,302,000
New Jersey	85,000	1,530,000	1,178,000
Pennsylvania	380,000	6,460,000	4,716,000
N. Atlantic	652,000	11,421,000	8,478,000
Delaware	1,000	16,000	11,000
Maryland	21,000	338,000	254,000
Virginia	20,000	270,000	216,000
West Virginia	12,000	155,000	140,000
North Carolina	15,000	150,000	152,000
South Carolina	4,000	40,000	58,000
Georgia	14,000	146,000	204,000
S. Atlantic	87,000	1,115,000	1,035,000
Ohio	56,000	924,000	665,000
Indiana	55,000	869,000	591,000
Illinois	70,000	1,218,000	865,000
Michigan	350,000	5,355,000	3,641,000
Wisconsin	305,000	4,880,000	3,465,000
N. Central E. of Miss. R.	836,000	13,246,000	9,227,000
Minnesota	115,000	1,955,000	1,251,000
Iowa	32,000	592,000	379,000
Missouri	14,000	210,000	158,000
North Dakota	15,000	128,000	81,000
South Dakota	35,000	595,000	363,000
Nebraska	75,000	1,200,000	720,000
Kansas	38,000	532,000	388,000
N. Central W. of Miss. R.	324,000	5,212,000	3,340,000
Kentucky	13,000	169,000	144,000
Tennessee	8,000	88,000	81,000
Alabama	2,000	24,000	29,000
Texas	4,000	46,000	47,000
Oklahoma	4,000	55,000	45,000
Arkansas	2,000	24,000	24,000
S. Central	33,000	406,000	370,000
Montana	4,000	80,000	54,000
Wyoming	1,000	18,000	15,000
Colorado	5,000	70,000	47,000
Utah	3,000	56,000	38,000
Idaho	4,000	80,000	53,000
Washington	6,000	123,000	109,000
Oregon	15,000	226,000	226,000
California	58,000	986,000	848,000
Far Western	96,000	1,639,000	1,390,000
United States	2,028,000	33,039,000	23,840,000

Condition of the rye crop in the United States on the first of months named, 1888–1911.

Year.	December of previous year.	April.	May.	June.	July.	August.	When harvested.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
1888	96.0	93.5	92.9	93.9	95.1	91.4	92.8
1889	97.2	93.9	96.5	95.2	96.7	95.4	91.6
1890	96.4	92.8	93.5	92.3	92.0	86.8	85.4
1891	99.0	95.4	97.2	95.4	93.9	89.6	95.1
1892	88.8	87.0	88.9	91.0	92.8	89.8	88.5
1893	89.4	85.7	82.7	84.6	85.3	78.5	82.0
1894	94.6	94.4	90.7	93.2	87.0	79.8	86.9
1895	96.2	87.0	88.7	85.7	80.7	84.0	83.7
1896	88.1	82.9	87.7	85.2	88.4	88.0	82.0
1897	99.8	88.9	88.0	89.9	93.4	89.8	90.1
1898	91.0	92.1	94.5	97.1	94.6	93.7	89.4
1899	98.9	84.9	85.2	84.5	84.9	89.0	82.0
1900	98.2	84.8	88.5	87.6	84.0	76.0	84.2
1901	99.1	93.1	94.6	93.9	93.5	83.6	84.9
1902	89.9	85.4	83.4	88.1	91.2	90.5	90.2
1903	98.1	97.9	93.3	90.6	90.2	87.2	84.1
1904	92.7	82.3	81.2	86.3	89.0	91.8	86.9
1905	90.5	92.1	93.5	93.6	92.9	92.6	90.8
1906	95.4	90.9	92.9	89.9	91.3	90.8	90.5
1907	96.2	92.0	88.0	88.1	89.7	88.9	....
1908	91.4	89.1	90.3	91.3	91.2	88.3	....
1909	87.6	87.2	88.1	89.6	91.4	89.1	....
1910	94.1	92.3	82.1	90.6	87.5	....	....
1911	92.6	89.3	....	....	....	....	....

RYE—Continued.

Average yield per acre of rye in the United States.

State, Territory, or Division.	10-year averages. 1866–1875.	1876–1885.	1886–1895.	1896–1905.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	1909.	1910.
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*
Vermont	16.5	15.9	13.8	17.4	18.3	16.9	19.4	16.9	15.0	17.4	17.0	15.0	15.5	17.5
Massachusetts	16.6	15.1	14.5	16.8	15.9	15.2	13.7	17.0	15.5	15.0	16.5	16.5	16.2	17.0
Connecticut	14.4	14.1	13.7	17.5	18.0	17.4	17.0	16.9	18.0	18.0	17.0	18.5	18.7	20.0
New York	14.2	13.0	13.6	16.0	14.9	17.5	15.2	14.8	16.0	17.6	16.5	16.5	17.0	18.3
New Jersey	13.7	11.8	12.4	15.8	15.0	16.4	13.8	17.5	18.0	17.2	17.5	16.2	16.3	18.0
Pennsylvania	13.6	12.0	12.6	16.1	15.9	16.0	15.6	15.5	17.0	17.4	16.7	16.5	15.3	17.0
North Atlantic	14.0	12.5	13.0	16.1	15.6	16.5	15.3	15.6	16.9	17.4	16.8	16.5	15.9	17.5
Delaware	9.0	10.9	8.0	13.1	15.3	13.5	14.8	11.8	10.0	15.0	16.5	15.5	14.0	15.5
Maryland	11.9	11.8	11.1	14.3	14.4	14.0	13.7	14.8	14.5	14.7	16.0	15.0	14.1	16.1
Virginia	10.1	7.9	8.2	11.2	11.1	9.6	12.2	15.7	11.8	13.4	14.0	12.5	12.3	13.5
West Virginia	13.0	10.2	9.3	11.0	12.0	8.1	11.5	12.5	11.8	12.2	12.0	13.0	13.5	12.9
North Carolina	8.8	7.0	6.4	8.6	8.5	8.2	8.8	9.9	9.5	11.0	10.5	8.9	9.4	10.0
South Carolina	6.2	5.0	5.6	7.1	7.7	7.6	7.6	7.5	8.1	8.5	10.0	9.6	9.8	10.0
Georgia	7.2	5.6	5.8	7.3	7.6	6.3	7.9	8.3	7.7	8.3	9.0	8.7	9.0	10.4
South Atlantic	10.4	8.0	8.0	10.6	10.7	9.5	10.9	12.4	11.1	12.0	12.5	11.7	11.7	12.8
Ohio	12.6	13.2	14.3	16.1	16.9	17.5	15.3	16.1	18.0	19.5	17.2	16.5	17.2	16.5
Indiana	14.0	12.4	13.9	13.9	14.5	14.5	12.6	14.6	15.4	17.0	17.0	15.0	16.5	15.8
Illinois	16.1	16.3	14.7	16.6	17.0	19.1	16.5	17.6	18.0	17.0	18.5	17.1	17.8	17.4
Michigan	15.6	13.0	13.4	14.5	14.0	17.9	15.5	13.2	16.0	14.5	14.5	15.5	15.5	15.3
Wisconsin	15.9	14.6	14.0	16.1	15.9	18.9	16.6	16.2	16.5	17.0	18.0	19.0	16.3	16.0
North Central East of Mississippi River	15.3	15.0	14.1	15.6	15.5	18.4	16.0	15.6	16.6	16.0	16.3	16.8	16.2	15.8
Minnesota	18.7	16.6	16.1	18.7	19.3	22.3	18.4	17.7	18.2	19.3	18.5	18.5	19.0	17.0
Iowa	18.4	13.4	15.3	17.6	18.4	17.4	16.9	17.2	17.5	18.6	17.8	20.0	17.8	18.5
Missouri	16.3	13.4	12.7	13.9	14.2	18.2	12.8	14.4	15.5	15.8	15.4	12.8	15.0	15.0
North Dakota	.....	.....	13.9	14.9	13.8	20.2	15.7	18.5	19.5	18.7	16.0	18.0	18.4	8.5
South Dakota	.....	.....	10.0	15.9	14.4	18.8	20.2	16.5	19.0	18.8	17.0	17.5	17.5	17.0
Nebraska	19.6	15.3	12.0	16.6	15.0	20.3	14.2	15.8	18.0	21.0	17.0	16.0	16.5	16.0
Kansas	19.3	17.4	11.0	13.4	14.3	12.0	16.2	13.2	15.7	16.0	12.0	13.3	14.2	14.0
North Central West of Mississippi River	17.5	14.5	10.9	16.5	16.1	18.6	16.2	16.1	17.6	18.8	16.6	17.0	17.4	16.1
Kentucky	11.0	10.3	10.8	12.8	14.0	13.4	11.6	13.7	15.0	15.2	13.7	13.5	12.7	13.0
Tennessee	9.6	7.5	7.4	10.9	11.3	11.0	13.4	11.7	12.1	13.0	10.0	12.5	10.7	11.0
Alabama	8.6	5.4	7.9	9.5	8.0	10.0	10.6	10.4	11.7	12.5	10.5	10.0	11.3	12.0
Texas	15.9	12.9	9.0	12.0	11.1	9.9	14.2	13.1	14.0	14.6	10.0	15.5	11.2	11.5
Oklahoma	.....	.....	.....	14.0	14.8	16.0	17.9	9.4	12.1	13.9	10.0	13.5	13.5	13.7
Arkansas	13.0	8.9	8.0	10.9	8.7	12.3	9.7	11.1	12.0	12.0	9.9	10.0	10.5	12.0
South Central	10.9	9.4	9.4	11.9	12.3	12.3	12.9	12.2	13.3	14.0	11.2	13.1	11.9	12.3
Montana	.....	.....	.....	23.2	26.7	25.0	24.6	19.9	20.0	20.5	22.0	20.0	29.0	20.0
Wyoming	.....	.....	.....	20.5	24.0	18.0	18.0	19.5	23.0	19.0	21.5	22.0	26.0	18.5
Colorado	.....	17.9	16.1	17.6	16.1	15.9	18.3	19.1	19.0	20.0	20.5	15.5	22.0	14.0
Utah	.....	10.2	13.9	16.3	14.2	12.4	16.1	16.0	18.0	24.0	20.0	15.5	22.0	18.5
Idaho	.....	.....	12.5	19.7	15.0	20.2	18.5	19.7	25.0	25.2	24.7	20.0	21.5	20.0
Washington	.....	16.4	15.3	17.9	17.5	17.8	21.0	19.0	18.5	19.6	21.5	19.5	21.0	20.5
Oregon	24.7	18.3	12.8	14.2	15.7	13.4	14.2	14.4	15.0	17.2	16.0	18.0	17.0	15.1
California	22.2	12.4	12.6	12.1	12.8	12.0	12.3	7.6	13.0	12.8	19.0	12.0	13.8	17.0
Far Western	22.5	12.9	13.2	13.3	13.9	12.9	13.5	9.9	14.1	14.7	19.0	13.4	15.9	17.1
United States	13.6	13.3	12.7	15.4	15.3	17.0	15.4	15.2	16.5	16.7	16.4	16.4	16.1	16.3

RYE—Continued.

Average farm value per acre of rye in the United States December 1.

State, Territory, or Division.	10-year averages. 1866–1875.	1876–1885.	1886–1895.	1896–1905.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	1909.	1910.
	Dolls.	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*
Vermont	16.83	13.20	10.07	11.66	14.64	13.01	12.61	12.51	9.75	10.79	12.78	13.50	15.50	15.00
Massachusetts	16.93	12.84	11.02	12.43	12.56	12.16	10.00	13.94	12.25	9.75	14.87	15.75	17.00	16.00
Connecticut	15.12	11.98	9.86	11.90	12.96	13.05	12.07	13.35	13.32	11.88	13.77	16.60	16.80	17.20
New York	12.21	9.49	8.57	9.28	9.24	10.15	9.27	10.80	10.72	11.44	13.36	13.37	13.60	13.54
New Jersey	12.33	8.85	7.81	9.16	8.85	10.00	8.83	12.25	11.88	10.49	13.30	13.13	12.89	13.86
Pennsylvania	11.15	8.76	7.56	8.86	9.54	8.48	9.67	11.01	11.05	11.14	12.52	12.71	12.24	12.41
N. Atlantic	12.04	9.30	8.09	9.16	9.48	9.20	9.53	11.17	11.13	11.12	12.89	13.02	12.79	13.00
Delaware	7.47	7.52	4.96	8.38	8.87	8.37	9.03	8.61	6.60	9.60	14.00	13.00	10.00	11.00
Maryland	9.52	8.26	6.55	8.15	8.06	8.12	8.08	11.25	9.43	8.82	11.98	11.53	11.00	12.10
Virginia	7.27	5.29	4.92	6.61	6.77	6.34	8.05	11.62	8.38	9.38	11.22	10.27	10.33	10.80
W. Virginia	10.27	7.14	5.95	7.04	7.80	5.51	8.17	9.63	8.26	8.54	9.91	11.00	12.09	11.67
N. Carolina	7.83	5.53	4.99	6.62	6.63	6.97	7.39	8.61	8.17	9.35	10.21	8.71	9.69	10.13
S. Carolina	8.37	6.15	5.43	7.53	8.55	8.59	8.13	9.45	9.64	10.63	12.63	13.00	13.75	14.50
Georgia	9.36	6.66	5.63	7.66	8.06	6.93	9.01	8.47	8.39	8.72	11.24	10.86	13.50	14.57
S. Atlantic	8.60	6.16	5.36	7.00	7.37	6.96	8.08	10.09	8.61	9.07	11.12	10.64	11.38	11.90
Ohio	9.20	8.58	8.01	8.69	9.30	9.27	8.87	11.91	11.16	11.12	12.91	12.53	13.07	11.88
Indiana	9.52	8.06	7.23	6.95	7.68	6.67	6.68	10.07	9.24	9.86	12.23	11.10	12.21	10.75
Illinois	9.34	9.45	7.35	8.30	9.69	9.55	8.58	12.32	10.80	9.52	13.13	12.48	13.17	12.36
Michigan	11.23	8.32	7.24	7.25	7.28	8.77	7.90	9.50	9.44	8.56	10.44	11.01	10.69	10.40
Wisconsin	9.54	8.47	7.00	7.89	8.27	9.45	8.30	11.18	9.73	9.86	12.96	13.49	11.08	11.36
N. C. E. of Miss. R.	9.52	8.85	7.26	7.74	8.18	9.11	8.15	10.88	9.81	9.30	11.75	12.05	11.31	11.04
Minnesota	9.91	8.63	7.24	8.23	9.46	9.59	8.28	11.33	9.65	9.65	12.21	11.66	11.40	10.88
Iowa	9.02	6.83	6.88	7.74	9.20	7.31	7.44	10.32	9.27	9.30	11.39	12.79	11.21	11.84
Missouri	10.27	7.64	6.22	7.51	9.51	8.74	7.04	9.22	9.61	9.48	11.10	9.73	12.27	11.29
N. Dakota	......	......	5.84	6.11	5.93	8.69	6.75	11.10	9.75	8.79	9.58	11.71	10.46	5.40
S. Dakota			4.20	6.36	6.19	7.71	8.08	9.41	9.31	8.46	10.52	10.31	10.33	10.37
Nebraska	10.78	6.27	4.80	6.47	6.90	7.31	5.25	8.69	8.64	9.24	10.02	9.60	10.06	9.60
Kansas	11.97	7.48	4.84	6.16	7.87	5.40	7.13	8.58	8.48	8.00	7.91	9.44	10.65	10.21
N. C. W. of Miss. R.	9.90	7.21	4.79	7.05	7.92	7.58	6.83	9.67	9.07	9.05	10.52	10.80	10.87	10.31
Kentucky	8.47	7.11	6.70	8.19	9.38	8.31	8.00	10.96	10.65	10.64	11.87	11.54	11.15	11.08
Tennessee	7.97	6.52	5.03	7.41	8.36	8.03	9.92	9.24	9.32	9.62	8.78	11.25	10.38	10.12
Alabama	11.09	6.43	7.82	10.16	8.32	10.50	11.45	12.48	13.34	13.12	13.12	12.50	15.50	14.50
Texas	16.54	11.48	6.93	9.24	10.32	7.52	10.51	11.27	11.90	12.41	10.00	15.25	13.75	11.75
Oklahoma	......	......	......	8.26	10.36	7.52	8.95	5.83	7.50	7.92	7.39	10.67	12.50	11.25
Arkansas	14.69	7.92	6.00	8.50	7.74	8.98	8.15	9.77	11.16	9.96	8.82	9.50	11.00	12.00
S. Central	8.79	7.06	6.22	8.09	9.05	8.20	9.18	9.88	10.30	10.42	10.08	11.81	11.70	11.21
Montana	......	......	......	15.31	16.02	16.00	15.50	15.32	13.00	13.53	15.24	13.50	22.00	13.50
Wyoming	......	......	......	12.30	19.20	9.00	12.42	7.80	14.26	13.68	15.00	16.00	23.00	15.00
Colorado	......	13.78	9.98	10.03	9.98	8.90	11.16	12.41	10.64	11.20	12.61	10.67	16.00	9.40
Utah	......	6.94	7.51	9.29	9.23	7.56	10.46	10.72	11.70	15.60	12.89	10.00	15.33	12.67
Idaho	......	8.64	7.38	12.80	10.05	12.12	12.02	14.77	14.00	15.12	15.29	13.50	15.00	13.25
Washington	......	12.46	10.40	11.46	10.85	11.39	15.12	15.01	12.95	12.74	16.55	17.33	19.75	18.17
Oregon	21.00	14.64	8.45	10.37	10.36	9.78	13.77	12.82	12.15	12.73	13.17	15.33	17.00	15.07
California	25.31	10.91	8.57	8.47	7.30	9.00	9.47	5.93	10.01	9.09	16.16	10.56	14.36	14.62
Far Western	24.75	10.93	8.63	9.18	8.27	9.30	10.44	7.76	10.58	10.21	15.54	11.32	15.28	14.48
United States	10.62	8.45	6.97	8.08	8.51	8.63	8.39	10.46	10.07	9.83	11.98	12.04	11.87	11.76

RYE—Continued.

Average farm price of rye per bushel in the United States.

State, Territory, or Division.	Price December 1, by decades.				Price December 1, by years.									Price bimonthly, 1910.					
	1866–1875.	1876–1885.	1886–1895.	1896–1905.	1901	1902	1903	1904	1905	1906	1907	1908	1909	Feb. 1.	Apr. 1.	June 1.	Aug. 1.	Oct. 1.	Dec. 1.
	Cts.	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*
Vermont	102	83	73	67	80	77	65	74	65	62	78	90	100	....	....	....	....	....	85
Massachusetts	102	85	76	74	79	80	73	82	79	65	90	95	105	98	105	101	98	95	94
Connecticut	105	85	72	68	72	75	71	79	74	66	81	90	90	88	84	82	95	90	86
New York	86	73	63	58	62	58	61	73	67	65	81	81	80	79	80	81	80	79	74
New Jersey	90	75	63	58	59	61	64	70	66	61	76	81	79	85	84	80	79	78	77
Pennsylvania	82	73	60	55	60	53	62	71	65	64	75	77	80	81	85	82	80	78	73
North Atlantic	86.0	74.4	62.2	56.9	60.8	55.9	62.2	71.6	65.9	63.9	76.7	78.9	80.3	81.1	83.5	81.5	80.2	78.5	74.2
Delaware	83	69	62	64	58	62	61	73	66	64	80	82	75	70	70	60	70	70	69
Maryland	80	70	59	57	56	58	59	76	65	60	75	77	78	75	79	73	71	76	75
Virginia	72	67	60	59	61	66	66	74	71	70	80	82	84	84	86	84	82	83	80
West Virginia	79	70	64	64	65	68	71	77	70	70	82	85	90	90	95	93	92	91	90
North Carolina	89	79	78	77	78	85	84	87	86	85	97	98	103	104	105	104	100	100	101
South Carolina	135	123	97	106	111	113	107	126	119	125	125	137	141	140	150	161	144	144	146
Georgia	130	119	97	105	106	110	114	102	109	105	125	125	150	155	158	150	147	150	140
South Atlantic	82.7	77.0	67.0	66.0	69.0	73.0	73.9	81.2	77.5	75.6	89.0	90.9	97.0	92.8	95.9	91.8	89.5	91.9	92.8
Ohio	73	65	56	54	55	53	58	74	62	57	75	76	76	76	77	78	73	74	72
Indiana	68	65	52	50	53	46	53	69	60	58	72	74	74	75	75	73	72	70	68
Illinois	58	58	50	50	57	50	52	70	60	56	71	73	74	75	74	72	75	74	71
Michigan	72	64	54	50	52	49	51	72	59	59	72	71	69	73	74	71	71	67	68
Wisconsin	60	58	50	49	52	50	50	69	59	58	72	71	68	73	72	70	72	70	71
N. C. E. of Miss. River	62.2	59.0	51.5	49.6	52.8	49.6	50.8	69.9	59.3	58.2	72.1	71.7	70.0	73.6	73.6	71.4	71.9	69.5	69.7
Minnesota	53	52	45	44	49	43	45	64	53	50	66	63	60	66	65	63	66	64	64
Iowa	49	51	45	44	50	42	44	60	53	50	64	64	63	66	68	68	64	67	64
Missouri	63	57	49	54	67	48	55	64	62	60	72	76	82	79	82	79	79	77	75
North Dakota	....	....	42	41	43	43	43	60	50	47	60	65	57	63	62	58	63	61	63
South Dakota	....	....	42	40	43	41	40	57	49	45	62	59	59	61	63	58	62	61	61
Nebraska	55	41	40	39	46	36	37	55	48	44	59	60	61	64	63	62	60	61	60
Kansas	62	43	44	46	55	45	44	65	54	50	66	71	75	73	74	73	72	76	73
N. C. W. of Miss. River	56.6	49.7	43.9	42.7	49.2	40.7	42.2	60.0	51.4	48.1	63.4	63.5	62.4	66.0	66.0	64.1	64.9	64.8	64.1
Kentucky	77	69	62	64	67	62	69	80	71	70	86	85	88	89	88	85	86	86	85
Tennessee	83	87	68	68	74	73	74	79	77	74	88	90	96	96	91	93	89	92	92
Alabama	129	119	99	107	104	105	108	120	114	105	125	123	136	145	128	147	124	135	120
Texas	104	89	77	77	93	76	74	86	85	85	100	98	123	125	114	106	112	109	103
Oklahoma	....	....	....	59	70	47	50	62	62	57	74	80	93	97	93	68	90	88	81
Arkansas	113	89	75	78	89	73	84	88	93	83	90	94	105	99	95	85	87	100	98
South Central	80.6	75.1	66.2	68.0	73.7	66.9	70.9	80.9	77.3	74.6	90.0	90.2	98.0	99.2	94.8	87.4	92.6	92.2	91.1
Montana	....	....	....	66	60	64	63	77	65	66	68	68	75	70	85	81	86	85	68
Wyoming	....	....	....	60	80	50	69	40	62	72	66	71	90	85	94	85	95	....	81
Colorado	....	77	62	57	62	56	61	65	56	56	62	70	73	72	74	82	81	67	67
Utah	....	68	54	57	65	61	65	67	65	65	65	65	70	70	76	82	68	68	68
Idaho	....	67	59	65	67	60	65	75	56	60	63	68	70	80	79	76	59	74	66
Washington	....	76	68	64	62	64	72	79	70	65	77	90	94	93	97	93	79	86	89
Oregon	85	80	66	73	66	73	97	89	81	74	82	85	100	97	105	104	96	100	100
California	114	88	68	70	57	75	77	78	77	71	85	88	104	100	89	87	90	83	86
Far Western	110.0	84.7	65.4	69.0	59.6	72.1	77.3	78.1	74.8	69.7	81.8	84.5	95.9	91.9	88.9	87.9	85.7	82.9	84.8
United States	78.1	63.5	54.9	52.5	55.7	50.8	54.5	68.8	61.1	58.9	73.1	73.6	73.9	76.1	76.6	74.8	74.4	72.8	72.2

RYE—Continued.

Wholesale prices of rye per bushel, 1897–1910.

Date.	Philadelphia.		Cincinnati.		Chicago.		Duluth.		San Francisco (per 100 lbs.).	
			No. 2.		No. 2.					
	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*		
1897	......	......	33	52	31	56	30	53	......	......
1898	......	......	40	80	41	75	40½	72	......	......
1899	......	......	56	68	49	62	47	59½	......	......
1900	......	......	51½	67	44½	60½	46	60½	......	......
1901	58	71½	45	73	46¾	65¾	46½	62½	$0.75	$0.87½
1902	54	71	51	71½	48	67½	46	64	.77½	1.15
1903	56	68½	54	63	48	60	48	55¼	1.10	1.30
1904	65	96	61	87	51	81	54½	80	1.25	1.47½
1905	63	90¼	56	87	57½	84	55½	78	1.40	1.75
1906	55½	67	58	72½	55½	68	53	61	......	......
1907.										
January	75	77	68	71	60	63	57	60	1.42½	1.47½
February	75	80	69	73	64	70	60	60	1.35	1.42½
March	75	80	71	74	64	70	60	60½	1.35	1.45
April	77	82	73	75	67	72	60	64	1.40	1.50
May	79	89	73	84	69	87½	64	78	1.40	1.50
June	93	98	81	88	84	88¾	80	82½	1.40	1.50
July	93	98	80	88	83	88	74	80	1.45	1.50
August	75	86	79	88	69	86	66	74	1.42½	1.50
September	90	95	84	91	85	91¼	75	85	1.40	1.47½
October	80	100	81	93	72	90	75	86	1.37½	1.45
November	85	95	79	84	75	80	67	76	1.40	1.45
December	85	95	78	84	75	82	70	76	1.40	1.52½
Year	75	100	68	93	60	91¼	57	86	1.35	1.52½
1908.										
January	93	95	81	89	79	87	71	78	1.45	1.52½
February	93	95	85	89	80	85	74	78	1.47½	1.52½
March	94	95	85	89	74	85	69	80	1.47½	1.52½
April	94	95	82	84	74	81	69	74	1.43¾	1.50
May	92	94	82	86	79	86	71	76	1.43¾	1.50
June	90	92	84	86	72	80	66	76	1.45	1.52½
July	90	92	78	86	72	80	60	73	1.45	1.50
August	80	85	78	81	75	78¾	71½	75	1.35	1.45
September	80	85	78	80	75½	77	71	74	1.40	1.45
October	81	86	78	82	74	76½	68½	74	1.40	1.47½
November	82	86	78	80	73	76	67	71	1.45	1.50
December	82	86	78	80	75	77½	67	72	1.42½	1.50
Year	80	95	78	89	72	87	60	80	1.35	1.52½
1909.										
January	90	95	78	82	74	77½	67	71	1.55	1.70
February	90	95	80	82	75½	79½	67	74	1.65	1.85
March	88	95	81	84	79	81	71	75	1.75	1.85
April	87	88	82	90	80	87	72	83	......	......
May	85	87	88	92	83	90	80	88	......	......
June	85	87	90	92	81	91	72	88	......	......
July	75	80	75	90	74	83½	69	76	......	......
August	75	82	70	85	67	76½	62	72	1.70	1.80
September	82	85	70	77½	70	74	62	67	1.80	1.85
October	85	86	75	78	71	75	64	71	......	......
November	85	86	76	80	73	77	67	71	2.00	2.05
December	86	87	77	81	72	80	68	74	......	......
Year	75	95	70	92	67	91	62	88	1.55	2.05
1910.										
January	90	92	79	87	79	82	71½	78½	Nominal.	
February	90	92	84	86	80	82	75	78½	1.97½	2.00
March	87	89	83	86½	78	80	72	78	1.97½	2.00
April	85	87	82	86	77½	80½	70	75	1.85	1.95
May	83	85	81	84	74	80	68	73	1.70	1.85
June	83	85	80	83	74	77	67	70	1.55	1.75
July	75	77	78	83	74	80	67	70	1.55	1.70
August	77	78	73	80	72	78	67	75	1.60	1.70
September	78	80	73	77	72½	74½	68	70	1.60	1.70
October	80	81	75	81	74½	77½	68	74	1.50	1.65
November	80	81	80	85	77	80½	71½	75	1.50	1.55
December	81	85½	83	87	80	81½	71½	76	1.50	1.60
Year	75	92	73	87	72	82	67	78½	1.50	2.00

RYE—Continued.

Average farm price of rye per bushel, on the first of each month, 1909–1910.

Month.	United States.		North Atlantic States.		South Atlantic States.		N. Cen. States East of Miss. R.		N. Cen. States West of Miss. R.		South Central States.		Far Western States.	
	1910.	1909.	1910.	1909.	1910.	1909.	1910.	1909.	1910.	1909.	1910.	1909.	1910.	1909.
	Cts.	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*
January	74.8	73.4	79.5	79.2	92.1	92.5	72.6	70.8	64.8	63.2	95.4	88.3	91.5	86.4
February	76.1	73.8	81.1	79.8	92.8	92.3	73.6	70.5	66.0	63.8	99.2	88.0	91.9	93.5
March	76.5	75.0	82.6	79.5	93.8	95.7	74.0	72.7	67.2	66.1	91.8	89.2	85.3	89.1
April	76.6	77.3	83.5	82.5	95.9	95.4	73.6	74.3	66.0	68.5	94.8	92.6	88.9	92.9
May	74.9	78.8	82.0	83.1	92.2	98.3	71.6	76.2	65.5	71.1	94.0	94.0	83.1	91.4
June	74.8	81.2	81.5	85.8	91.8	95.8	71.4	78.8	64.1	74.1	87.4	91.9	87.9	91.0
July	74.6	81.7	81.5	88.0	91.4	98.5	71.9	78.9	64.5	72.3	88.8	92.6	82.5	92.0
August	74.4	78.5	80.2	86.5	89.5	95.2	71.9	75.5	64.9	67.7	92.6	89.1	85.7	85.8
September	74.1	72.4	80.1	80.4	91.8	94.5	70.7	68.1	66.3	61.9	91.8	92.9	82.2	86.0
October	72.8	72.8	78.5	81.0	91.9	96.7	69.5	68.7	64.8	61.9	92.2	97.6	82.9	81.0
November	71.6	73.6	75.7	80.1	93.4	95.9	69.5	70.7	63.2	62.4	91.2	98.2	81.9	84.7
December	72.2	73.9	74.2	80.3	92.8	97.0	69.7	70.0	64.1	62.4	91.1	98.0	84.8	95.9

Average yield of rye in countries named, bushels per acre, 1890–1909.

Year.	United States.	Russia, European. [a]	Germany. [a]	Austria. [a]	Hungary proper. [a]	France. [b]	Ireland. [b]
Average (1890–1899)	13.9	10.4	20.9	16.1	....	17.6	25.2
1900	15.1	12.7	22.9	13.0	15.8	16.9	25.7
1901	15.3	10.3	22.4	16.9	15.8	16.7	27.3
1902	17.0	12.5	24.6	18.2	19.1	14.3	28.1
1903	15.4	12.2	26.2	18.2	18.6	18.1	26.9
1904	15.2	13.7	26.3	19.3	17.0	16.6	26.0
1905	16.5	10.1	24.9	20.2	19.4	18.5	27.0
1906	16.7	8.8	25.1	19.9	19.8	16.3	27.6
1907	16.4	10.8	25.8	18.9	16.0	18.2	27.0
1908	16.4	11.0	28.0	22.0	17.5	16.8	29.2
1909	16.1	12.6	28.8	22.3	17.8	18.1	30.8
Average (1900–1909)	16.0	11.5	25.6	19.0	17.6	17.1	27.5

[a] Bushels of 56 pounds. [b] Winchester bushels.

BUCKWHEAT.

Acreage, production, and value of buckwheat in the United States, 1849–1910.

Year.	Acreage sown and harvested.	Average yield per acre.	Production.	Average farm price per bushel Dec. 1.	Farm value Dec. 1.
	Acres.	*Bushels.*	*Bushels.*	*Cents.*	*Dollars.*
1849 [a]			8,957,000		
1859 [a]			17,572,000		
1866	1,046,000	21.8	22,792,000	67.6	15,413,000
1867	1,228,000	17.4	21,359,000	78.7	16,812,000
1868	1,114,000	17.8	19,864,000	78.0	15,490,000
1869	1,029,000	16.9	17,431,000	71.9	12,535,000
1870	537,000	18.3	9,842,000	70.5	6,937,000
1871	414,000	20.1	8,329,000	74.5	6,208,000
1872	448,000	18.1	8,134,000	73.5	5,979,000
1873	454,000	17.3	7,838,000	75.0	5,879,000
1874	453,000	17.7	8,017,000	72.9	5,844,000
1875	576,000	17.5	10,082,000	62.0	6,255,000
1876	666,000	14.5	9,669,000	66.6	6,436,000
1877	650,000	15.7	10,177,000	66.9	6,808,000
1878	673,000	18.2	12,247,000	52.6	6,441,000
1879	640,000	20.5	13,140,000	59.8	7,856,000
1880	823,000	17.8	14,618,000	59.4	8,682,000
1881	829,000	11.4	9,486,000	86.5	8,206,000
1882	847,000	13.0	11,019,000	73.0	8,039,000
1883	857,000	8.9	7,669,000	82.2	6,304,000
1884	879,000	12.6	11,116,000	58.9	6,549,000
1885	914,000	13.8	12,626,000	55.9	7,057,000
1886	918,000	12.9	11,869,000	54.5	6,465,000
1887	911,000	11.9	10,844,000	56.5	6,122,000
1888	913,000	13.2	12,050,000	63.3	7,628,000
1889	837,000	14.5	12,110,000	50.5	6,113,000
1890	845,000	14.7	12,433,000	57.4	7,133,000
1891	849,000	15.0	12,761,000	57.0	7,272,000
1892	861,000	14.1	12,143,000	51.8	6,296,000
1893	816,000	14.9	12,132,000	58.3	7,074,000
1894	789,000	16.1	12,668,000	55.6	7,040,000
1895	763,000	20.1	15,341,000	45.2	6,936,000
1896	755,000	18.7	14,090,000	39.2	5,522,000
1897	718,000	20.9	14,997,000	42.1	6,319,000
1898	678,000	17.3	11,722,000	45.0	5,271,000
1899	670,000	16.6	11,094,000	55.7	6,184,000
1900	638,000	15.0	9,567,000	55.8	5,341,000
1901	811,000	18.6	15,126,000	56.3	8,523,000
1902	805,000	18.1	14,530,000	59.6	8,655,000
1903	804,000	17.7	14,244,000	60.7	8,651,000
1904	794,000	18.9	15,008,000	62.2	9,331,000
1905	760,000	19.2	14,585,000	58.7	8,565,000
1906	789,000	18.6	14,642,000	59.6	8,727,000
1907	800,000	17.9	14,290,000	69.8	9,975,000
1908	803,000	19.8	15,874,000	75.6	12,004,000
1909	834,000	20.9	17,438,000	69.9	12,188,000
1910	826,000	20.9	17,239,000	65.7	11,321,000

[a] Census figures.

BUCKWHEAT—Continued.

Acreage, production, and value of buckwheat in the United States in 1910.

State, Territory, or Division.	Acreage sown and harvested.	Production.	Farm value December 1.
	Acres.	*Bushels.*	*Dollars.*
Maine	23,000	748,000	509,000
New Hampshire	2,000	62,000	38,000
Vermont	8,000	192,000	134,000
Massachusetts	3,000	66,000	56,000
Connecticut	3,000	58,000	48,000
New York	313,000	7,199,000	4,679,000
New Jersey	13,000	280,000	193,000
Pennsylvania	290,000	5,655,000	3,506,000
N. Atlantic	655,000	14,260,000	9,163,000
Delaware	2,000	41,000	27,000
Maryland	9,000	166,000	110,000
Virginia	21,000	378,000	291,000
West Virginia	25,000	575,000	443,000
North Carolina	5,000	95,000	76,000
S. Atlantic	62,000	1,255,000	947,000
Ohio	14,000	252,000	189,000
Indiana	5,000	88,000	62,000
Illinois	4,000	80,000	72,000

State, Territory, or Division.	Acreage.	Production.	Farm value December 1.
	Acres.	*Bushels.*	*Dollars.*
Michigan	55,000	842,000	522,000
Wisconsin	14,000	196,000	147,000
N. C. E. of Miss. R.	92,000	1,458,000	992,000
Minnesota	4,000	64,000	46,000
Iowa	8,000	119,000	99,000
Missouri	2,000	33,000	29,000
Nebraska	1,000	20,000	18,000
Kansas	1,000	15,000	14,000
N. C. W. of Miss. R.	16,000	251,000	206,000
Tennessee	1,000	15,000	13,000
S. Central	1,000	15,000	13,000
United States	826,000	17,239,000	11,321,000

Condition of the buckwheat crop in the United States on first of months named, 1890–1910.

Year.	Aug.	Sept.	When harvested.	Year.	Aug.	Sept.	When harvested.	Year.	Aug.	Sept.	When harvested.
	P. ct.	*P. ct.*	*P. ct.*		*P. ct.*	*P. ct.*	*P. ct.*		*P. ct.*	*P. ct.*	*P. ct.*
1890	90.1	90.5	90.7	1897	94.9	95.1	90.8	1904	92.8	91.5	88.7
1891	97.3	96.6	92.7	1898	87.2	88.8	76.2	1905	92.6	91.8	91.6
1892	92.9	89.0	85.6	1899	93.2	75.2	70.2	1906	93.2	91.2	84.9
1893	88.8	77.5	73.5	1900	87.9	80.5	72.8	1907	91.9	77.4	80.1
1894	82.3	69.2	72.0	1901	91.1	90.9	90.5	1908	89.4	87.8	81.6
1895	85.2	87.5	84.8	1902	91.4	86.4	80.5	1909	86.4	81.1	79.5
1896	96.0	93.2	86.0	1903	93.9	91.0	83.0	1910	87.9	82.3	81.7

Average farm price of buckwheat per bushel on the first of each month, 1909–1910.

Month.	United States.		North Atlantic States.		South Atlantic States.		N. Cen. States East of Miss. R.		N. Cen. States West of Miss. R.		South Central States.		Far Western States.	
	1910.	1909.	1910.	1909.	1910.	1909.	1910.	1909.	1910.	1909.	1910.	1909.	1910.	1909.
	Cts.	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*
January	70.0	74.3	68.7	73.7	81.2	77.5	72.8	77.1	80.5	75.3	88.0	65.0	......	......
February	72.0	74.2	71.1	73.8	79.6	76.6	73.9	75.7	78.5	77.0	88.0	80.0	......	......
March	70.6	75.5	69.5	74.8	80.5	77.7	72.7	78.5	79.5	80.9	......	80.0	......	......
April	73.4	76.2	72.9	75.1	78.8	80.8	73.5	80.2	83.0	88.2	85.0	84.0	......	......
May	71.0	78.8	70.0	77.6	81.1	86.0	71.7	80.7	83.5	96.9	79.0	89.0	......	......
June	73.7	83.4	72.5	83.1	82.9	85.4	76.9	83.5	83.5	90.7	80.0	75.0	......	......
July	78.0	86.9	77.3	86.8	82.7	87.5	80.0	86.7	90.5	92.2	82.0	85.0	......	......
August	74.8	82.9	74.2	82.9	80.8	83.2	75.3	81.5	86.0	93.2	82.0	90.0	......	......
September	72.6	76.9	71.6	76.3	79.9	80.4	74.4	77.9	90.5	84.0	......	77.0	......	......
October	71.3	74.8	70.3	74.0	77.7	80.4	72.8	75.2	90.0	88.9	......	74.0	......	......
November	65.9	71.6	64.3	70.6	76.2	78.5	72.6	74.0	72.5	81.9	90.0	73.0	......	......
December	65.7	69.9	64.3	69.0	75.5	75.5	68.0	71.7	82.1	82.7	86.0	79.0	......	......

BUCKWHEAT—Continued.

Average yield per acre of buckwheat in the United States.

State, Territory, or Division.	10-year averages. 1866–1875.	1876–1885.	1886–1895.	1896–1905.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	1909.	1910.
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*
Maine	23.1	21.6	23.4	31.0	31.7	30.4	29.8	32.5	30.0	28.0	28.0	30.0	28.0	32.5
New Hampshire	19.8	19.1	19.9	22.5	21.0	20.0	19.6	25.1	23.0	22.0	22.0	21.5	22.0	31.0
Vermont	21.3	20.7	21.8	24.4	25.1	25.0	24.0	26.3	19.0	21.0	22.0	22.0	22.0	24.0
Massachusetts	14.8	13.5	16.3	17.8	18.9	14.4	13.7	16.2	20.0	20.0	21.0	18.0	19.3	22.0
Connecticut	17.1	12.9	13.8	17.1	18.0	18.4	17.5	16.3	16.0	17.0	16.0	18.2	19.5	19.5
New York	20.0	14.8	15.8	17.7	18.8	17.7	18.3	18.8	19.0	19.0	17.5	21.4	24.0	23.0
New Jersey	17.2	14.3	13.4	19.6	19.0	22.5	18.1	20.8	21.0	18.0	16.5	20.0	21.8	21.5
Pennsylvania	19.0	14.6	14.7	18.2	19.5	18.1	16.5	18.8	20.0	19.0	18.0	19.2	19.5	19.5
North Atlantic	19.7	15.1	15.8	18.6	19.7	18.6	18.1	19.5	19.8	19.3	18.1	20.8	22.0	21.8
Delaware	19.5	.....	14.6	16.4	17.8	15.2	15.2	12.1	17.0	17.0	24.0	30.0	19.8	20.5
Maryland	17.5	15.3	12.9	17.0	17.5	17.0	16.3	18.2	19.0	18.0	19.0	18.5	16.6	18.5
Virginia	15.1	13.2	10.4	16.2	15.9	16.6	18.6	17.0	18.0	19.0	19.0	18.0	18.0	18.0
West Virginia	16.7	13.8	12.9	19.1	20.6	22.5	17.2	19.1	19.0	18.0	18.5	18.0	22.7	23.0
North Carolina	17.2	10.2	10.6	15.2	15.6	14.5	12.1	14.7	15.0	14.0	15.5	16.4	19.8	19.0
South Atlantic	16.7	13.5	12.3	17.2	18.0	18.7	17.0	17.6	18.2	17.9	18.6	18.1	19.7	20.2
Ohio	14.4	12.5	12.7	16.9	16.1	13.9	16.6	16.9	17.0	19.0	19.5	18.5	21.2	18.0
Indiana	16.0	12.9	11.6	16.7	13.1	17.6	16.8	16.1	17.0	16.0	15.5	17.0	17.3	17.7
Illinois	14.8	12.3	12.1	14.6	11.0	15.5	15.3	17.9	16.0	19.0	17.0	18.2	18.2	20.0
Michigan	17.1	14.6	13.6	14.6	14.1	13.0	15.5	15.4	16.0	13.0	15.5	13.5	14.3	15.3
Wisconsin	16.3	12.8	12.0	15.3	12.4	16.0	15.6	17.7	15.0	15.0	16.0	15.2	12.3	14.0
N. Central E. of Miss. River	16.1	13.2	12.7	15.2	13.5	14.5	15.7	16.5	15.9	14.7	16.2	15.0	15.3	15.8
Minnesota	16.9	12.8	12.3	14.7	14.5	13.9	15.2	15.1	14.0	14.0	14.7	18.2	15.2	16.0
Iowa	18.2	12.9	12.1	15.3	13.5	16.0	15.1	14.8	13.0	12.0	15.0	15.5	15.0	14.9
Missouri	18.8	14.3	10.9	14.6	6.0	16.1	14.8	13.5	16.0	18.0	16.0	20.1	21.0	16.5
Nebraska	19.9	13.1	9.4	15.4	11.5	14.7	19.0	14.7	14.0	15.0	14.5	18.0	16.0	20.0
Kansas	18.3	13.3	10.4	12.7	7.9	12.0	18.4	14.0	11.0	17.0	12.0	18.7	14.0	15.0
N. Central W. of Miss. River	18.0	13.2	11.4	14.8	12.2	14.6	15.4	14.6	13.5	13.6	14.8	16.9	15.7	15.7
Tennessee	12.3	11.9	9.7	16.4	14.2	18.0	14.7	15.5	16.0	16.0	15.0	15.3	15.0	15.0
South Central	12.4	11.7	10.0	16.0	14.2	18.0	14.7	15.5	16.0	16.0	15.0	15.3	15.0	15.0
United States	18.3	14.6	14.7	18.1	18.6	18.1	17.7	18.9	19.2	18.6	17.9	19.8	20.9	20.9

Average farm value per acre of buckwheat in the United States December 1.

State, Territory, or Division.	10-year averages. 1866–1875.	1876–1885.	1886–1895.	1896–1905.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	1909.	1910.
	Dolls.	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*
Maine	15.48	12.10	12.87	14.88	15.22	15.81	15.20	16.90	19.50	16.52	18.22	22.52	19.61	22.13
N. Hampshire	13.07	12.03	11.34	13.05	11.55	13.00	11.56	17.07	16.33	16.06	16.50	17.00	16.50	19.00
Vermont	14.06	12.42	11.34	12.44	14.81	14.00	13.20	14.73	9.69	12.18	15.38	15.38	16.75	16.75
Massachusetts	11.54	9.45	11.08	11.93	11.53	10.66	9.32	11.66	14.20	13.60	15.00	14.50	14.67	18.67
Connecticut	14.71	9.68	8.83	10.94	11.70	13.06	12.42	11.90	11.68	12.75	12.00	14.67	19.33	16.00
New York	14.00	9.62	8.53	9.38	10.72	10.44	10.80	11.47	11.21	11.59	12.25	16.27	16.56	14.95
New Jersey	14.79	10.44	8.17	11.17	9.88	14.40	11.58	13.73	13.23	10.80	12.42	15.00	16.08	14.85
Pennsylvania	14.44	9.93	8.09	9.65	10.92	11.04	10.56	11.84	11.20	10.83	12.42	14.40	13.26	12.09
N. Atlantic	14.28	9.98	8.63	9.86	11.03	11.05	10.93	11.93	11.57	11.48	12.56	15.70	15.20	13.99
Delaware	15.99	9.25	8.32	8.20	9.79	9.12	8.36	7.50	9.69	10.37	17.00	22.00	12.00	13.50
Maryland	13.82	10.40	7.87	9.86	10.50	10.37	10.27	11.47	11.97	10.80	12.78	14.00	12.22	12.22
Virginia	9.82	8.45	6.14	8.91	8.90	9.96	11.35	10.88	11.16	11.02	13.89	12.95	13.67	13.86
W. Virginia	12.52	9.11	8.13	11.27	12.15	13.95	11.70	13.75	12.54	11.70	13.86	14.57	17.23	17.72
N. Carolina	10.66	6.73	5.83	8.97	9.67	8.99	7.86	10.44	9.90	8.96	11.00	12.80	15.80	15.20
S. Atlantic	12.21	8.91	7.52	9.82	10.50	11.44	10.90	11.92	11.64	11.02	13.48	13.85	14.90	15.27

BUCKWHEAT—Continued.

Average farm value per acre of buckwheat in the United States December 1—Continued.

State, Territory, or Division.	10-year averages.				1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	1909.	1910.
	1866–1875.	1876–1885.	1886–1895.	1896–1905.										
	Dolls.	*Dolls.*	*Dolls.*	*Dolls*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*
Ohio	11.52	9.38	8.00	9.80	9.66	8.48	10.79	12.17	10.54	10.83	14.69	15.15	16.53	13.50
Indiana	11.36	9.68	7.08	10.02	7.99	10.21	11.76	11.27	11.05	10.24	11.25	13.29	13.67	12.40
Illinois	10.80	9.22	7.26	9.34	7.70	11.01	11.17	13.96	10.88	14.25	13.50	16.40	14.50	18.00
Michigan	11.29	9.49	7.21	7.30	7.19	6.89	8.37	9.39	8.48	7.15	10.07	9.58	9.43	9.49
Wisconsin	10.11	8.19	6.36	8.26	7.32	9.44	9.52	11.15	8.40	9.30	11.50	11.55	9.56	10.50
N. C. E. of Miss. R.	10.93	9.12	6.91	8.16	7.57	8.37	9.39	10.65	8.99	8.56	11.19	11.32	10.96	10.78
Minnesota	12.17	8.19	6.64	7.79	8.99	7.92	8.06	9.06	7.98	7.56	10.80	13.20	10.80	11.50
Iowa	12.74	9.03	7.50	9.33	9.45	11.20	10.72	9.92	9.10	9.12	12.00	12.11	12.78	12.38
Missouri	12.60	9.58	6.98	10.22	4.56	9.34	11.10	11.48	13.12	13.32	14.00	17.00	18.50	14.50
Nebraska	17.51	9.82	5.64	9.55	6.67	7.79	13.11	13.38	8.82	9.30	12.00	15.00	14.00	18.00
Kansas	15.92	10.51	7.38	9.52	5.92	9.00	14.35	11.20	7.59	12.58	10.00	17.00	14.00	14.00
N. C. W. of Miss. R.	13.01	9.23	6.82	8.85	8.18	9.38	10.33	10.12	9.09	9.35	11.71	13.15	13.00	12.88
Tennessee	10.09	8.45	5.63	10.33	8.38	13.68	9.70	11.01	10.88	13.28	12.00	12.00	11.00	13.00
S. Central	10.25	8.17	5.45	10.67	8.38	13.68	9.70	11.01	10.88	13.28	12.00	12.24	11.00	13.00
United States	13.27	9.67	8.08	9.68	10.51	10.75	10.75	11.76	11.27	11.06	12.47	14.95	14.61	13.71

Average farm price of buckwheat per bushel in the United States.

State, Territory, or Division.	Price December 1, by decades				Price December 1, by years.									Price bimonthly, 1910.					
	1866–1875.	1876–1885.	1886–1895.	1896–1905.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	1909.	Feb. 1.	Apr. 1.	June 1.	Aug. 1.	Oct. 1.	Dec. 1.
	Cts.	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*
Maine	67	56	55	48	48	52	51	52	65	59	65	75	70	74	76	73	74	72	68
New Hampshire	66	63	57	58	55	65	59	68	71	73	75	80	76	80	78	72	77	80	62
Vermont	66	60	52	51	59	56	55	56	51	58	70	70	76	84	85	80	80	70	70
Massachusetts	78	70	68	67	61	74	68	72	71	68	70	80	75	....	100	92	93	88	85
Connecticut	86	75	64	64	65	71	71	73	73	75	75	80	100	97	88	82	97	100	83
New York	70	65	54	53	57	59	59	61	59	61	70	76	69	70	73	73	75	71	65
New Jersey	86	73	61	57	52	64	64	66	63	60	75	75	74	74	75	74	77	78	69
Pennsylvania	76	68	55	53	56	61	64	63	56	57	69	75	68	71	71	71	72	68	62
North Atlantic	72.5	66.1	54.6	53.0	56.0	59.5	60.4	61.3	58.3	59.4	69.4	75.5	69.0	71.1	72.9	72.5	74.2	70.3	64.3
Delaware	82	69	57	50	55	60	55	62	57	61	69	72	60	....	....	60	....	65	65
Maryland	79	68	61	58	60	61	63	63	63	60	67	76	74	76	70	83	77	70	66
Virginia	65	64	59	55	56	60	61	64	62	58	73	72	76	82	77	82	78	78	77
West Virginia	75	66	63	59	59	62	68	72	66	65	75	81	76	78	79	81	82	78	77
North Carolina	62	66	55	59	62	62	65	71	66	64	71	78	80	82	94	96	89	90	80
South Atlantic	73.1	66.0	61.1	57.1	58.4	61.2	64.1	67.7	64.0	61.6	72.5	76.5	75.5	79.6	78.8	82.9	80.8	77.7	75.5
Ohio	80	75	63	58	60	61	65	72	62	57	75	82	78	80	77	78	74	76	75
Indiana	71	75	61	60	61	58	70	70	65	64	73	78	77	85	85	87	81	78	70
Illinois	73	75	60	64	70	71	73	78	68	75	80	90	80	90	99	100	92	90	90
Michigan	66	65	53	50	51	53	54	61	53	55	65	71	66	68	67	72	73	68	62
Wisconsin	62	64	53	54	59	59	61	63	56	62	72	76	78	75	76	78	75	76	75
N. C. E. of Miss. River	67.9	69.1	54.4	53.7	55.9	57.6	59.7	64.7	56.7	58.4	69.1	75.5	71.7	73.9	73.5	76.9	75.3	72.8	68.0
Minnesota	72	64	54	53	62	57	53	60	57	54	73	73	71	67	70	74	71	82	72
Iowa	70	70	62	61	70	70	71	67	70	76	80	78	85	90	96	93	101	100	83
Missouri	67	67	64	70	76	58	75	85	82	74	90	85	90	85	94	91	95	90	87
Nebraska	88	75	60	62	58	53	69	91	63	62	88	83	90	90	85	87	80	79	90
Kansas	87	79	71	75	75	75	78	80	69	74	82	91	100	....	....	100	....	....	90
N. C. W. of Miss. River	72.3	69.9	59.8	59.8	66.8	64.2	66.9	69.4	67.4	68.8	79.1	77.8	82.7	78.5	83.0	83.5	86.0	90.0	82.1
Tennessee	82	71	58	63	59	76	66	71	68	83	80	80	79	88	85	80	82	....	86
South Central	82.7	69.8	54.5	66.7	59.0	76.0	66.0	71.0	68.0	83.0	80.0	80.0	79.0	88.0	85.0	80.0	82.0	....	86.0
United States	72.5	66.2	55.0	53.5	56.3	59.6	60.7	62.2	58.7	59.6	69.8	75.6	69.9	72.0	73.4	73.7	74.8	71.3	65.7

POTATOES.

Potato crop of countries named, 1905–1909.

[No statistics for Portugal, Egypt, and some other less important potato-growing countries.]

Countries.	1905.	1906.	1907.	1908.	1909.
NORTH AMERICA.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
United States (contiguous)	260,741,000	308,038,000	298,262,000	278,985,000	376,537,000
Canada:					
Prince Edward Island	(a)	(a)	5,453,000	7,327,000	6,761,000
Nova Scotia	(a)	(a)	8,294,000	7,884,000	9,098,000
New Brunswick	5,693,000	5,522,000	5,183,000	11,203,000	12,247,000
Quebec	(a)	(a)	22,911,000	16,680,000	30,853,000
Ontario	14,819,000	15,494,000	20,908,000	23,096,000	29,465,000
Manitoba	2,901,000	4,281,000	4,150,000	3,807,000	4,118,000
Saskatchewan	2,844,000	5,507,000	2,706,000	1,826,000	3,944,000
Alberta			2,632,000	1,967,000	2,599,000
Other	[b] 29,000,000	[b] 29,000,000			
Total Canada	55,257,000	59,804,000	72,237,000	73,790,000	99,085,000
Mexico	469,000	924,000	[c] 924,000	[c] 924,000	[c] 924,000
Newfoundland [b]	1,350,000	1,350,000	1,350,000	1,350,000	1,350,000
Total	317,817,000	370,116,000	372,773,000	355,049,000	477,896,000
SOUTH AMERICA.					
Argentina	[d] 10,000,000	[d] 10,000,000	[d] 10,000,000	[e] 10,000,000	[d] 10,000,000
Chile	6,532,000	[f] 6,532,000	[f] 6,532,000	8,063,000	6,404,000
Total	16,532,000	16,532,000	16,532,000	18,063,000	16,404,000
EUROPE.					
Austria-Hungary:					
Austria	581,822,000	514,289,000	538,789,000	475,860,000	479,616,000
Hungary, proper	168,225,000	179,083,000	178,168,000	139,469,000	183,521,000
Croatia-Slavonia	12,589,000	12,854,000	25,625,000	21,129,000	[g] 21,129,000
Bosnia-Herzegovina	2,485,000	2,328,000	2,949,000	[g] 2,949,000	[h] 2,949,000
Total Austria-Hungary	765,121,000	708,554,000	745,531,000	639,407,000	687,215,000
Belgium	57,159,000	88,652,000	88,192,000	82,846,000	[g] 82,846,000
Bulgaria	300,000	364,000	300,000	340,000	323,000
Denmark	29,954,000	28,454,000	24,005,000	29,752,000	24,326,000
Finland	20,704,000	20,432,000	18,765,000	[g] 18,765,000	[h] 18,765,000
France	523,876,000	372,076,000	512,229,000	625,021,000	613,041,000
Germany	1,775,579,000	1,577,653,000	1,673,246,000	1,702,803,000	1,716,143,000
Greece	[i] 550,000	[i] 550,000	[i] 550,000	[i] 550,000	[j] 550,000
Italy	[k] 60,009,000	[k] 60,000,000	[k] 60,000,000	[k] 60,000,000	63,273,000
Luxemburg	6,400,000	6,491,000	7,295,000	5,878,000	6,099,000
Malta	387,000	378,000	793,000	692,000	372,000
Netherlands	87,043,000	95,503,000	94,401,000	96,695,000	97,275,000
Norway	25,832,000	20,995,000	16,956,000	28,030,000	22,084,000
Roumania	3,733,000	4,636,000	3,860,000	4,310,000	3,813,000

[a] Included in "other."
[b] Estimated from returns of census year, 1900.
[c] Data for 1906.
[d] Data for 1908.
[e] Census shows 19,000 hectares (46,949 acres) yielding 15,000 kilograms per hectare (223 bushels per acre).
[f] Data for 1905.
[g] Year preceding.
[h] Data for 1907.
[i] Data for 1909.
[j] Unofficial estimate.
[k] Average production as unofficially estimated.

POTATOES—Continued.

Potato crop of countries named, 1905–1909—Continued.

Countries.	1905.	1906.	1907.	1908.	1909.
EUROPE—continued.					
Russia:	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Russia proper	686,502,000	630,211,000	694,487,000	682,454,000	764,943,000
Poland	331,529,000	296,662,000	327,689,000	366,433,000	396,023,000
Northern Caucasia	14,857,000	12,844,000	11,932,000	11,248,000	12,520,000
Total Russia (European)	1,032,888,000	939,717,000	1,034,108,000	1,060,135,000	1,173,486,000
Servia	1,232,000	1,799,000	876,000	645,000	645,000
Spain	a 84,000,000	a 84,000,000	a 84,000,000	a 84,000,000	91,014,000
Sweden	74,819,000	63,829,000	57,823,000	78,020,000	61,981,000
Switzerland	b 47,000,000	b 47,000,000	b 47,000,000	49,971,000	44,092,000
United Kingdom:					
Great Britain	140,474,000	128,005,000	111,159,000	146,258,000	137,237,000
Ireland	127,793,000	99,328,000	83,869,000	119,455,000	119,572,000
Total Great Britain and Ireland	268,267,000	227,333,000	195,028,000	265,713,000	256,809,000
Total	4,864,844,000	4,348,416,000	4,664,958,000	4,833,573,000	4,964,152,000
ASIA.					
Japan	16,255,000	18,691,000	20,310,000	21,174,000	a 21,174,000
Russia (Asiatic)	18,865,000	16,481,000	17,076,000	22,588,000	18,753,000
Total	35,120,000	35,172,000	37,386,000	43,762,000	39,927,000
AFRICA.					
Algeria	1,605,000	1,684,000	1,803,000	1,549,000	1,679,000
Union of South Africa:					
Cape of Good Hope	c 1,500,000	c 1,500,000	c 1,500,000	1,304,000	d 1,304,000
Natal	466,000	454,000	444,000	405,000	392,000
Transvaal	e 618,000	e 618,000	549,000	519,000	410,000
Total, Union of South Africa	2,584,000	2,572,000	2,493,000	2,228,000	2,106,000
Total	4,189,000	4,256,000	4,296,000	3,777,000	3,785,000
AUSTRALASIA.					
Australia:					
Queensland	718,000	422,000	591,000	492,000	431,000
New South Wales	1,820,000	1,881,000	4,288,000	2,086,000	2,680,000
Victoria	3,467,000	4,307,000	6,229,000	5,044,000	5,706,000
South Australia	729,000	756,000	832,000	756,000	805,000
Western Australia	210,000	235,000	188,000	212,000	250,000
Tasmania	4,127,000	2,412,000	6,807,000	5,431,000	4,540,000
Total Australia	11,071,000	10,013,000	18,935,000	14,021,000	14,412,000
New Zealand	5,025,000	4,607,000	6,342,000	5,339,000	7,288,000
Total Australasia	16,096,000	14,620,000	25,277,000	19,360,000	21,700,000
Grand total	5,254,598,000	4,789,112,000	5,121,222,000	5,273,584,000	5,523,864,000

a Average production as unofficially estimated.
b Average, 1908–1909.
c Unofficial estimate.
d Year preceding.
e Data for 1904.

POTATOES—Continued.

Acreage, production, and value of potatoes in the United States in 1910.

State, Territory, or Division.	Acreage.	Production.	Farm value December 1.
	Acres.	*Bushels.*	*Dollars.*
Maine	127,000	27,940,000	11,735,000
N. Hampshire	21,000	3,150,000	1,638,000
Vermont	29,000	3,770,000	1,696,000
Massachusetts	35,000	4,375,000	3,062,000
Rhode Island	6,000	816,000	563,000
Connecticut	35,000	4,375,000	3,062,000
New York	438,000	44,676,000	21,444,000
New Jersey	95,000	9,975,000	6,484,000
Pennsylvania	320,000	28,160,000	14,643,000
N. Atlantic	1,106,000	127,237,000	64,327,000
Delaware	10,000	1,030,000	618,000
Maryland	36,000	3,420,000	1,847,000
Virginia	67,000	6,566,000	3,808,000
West Virginia	41,000	3,772,000	2,527,000
North Carolina	26,000	2,314,000	1,689,000
South Carolina	10,000	900,000	945,000
Georgia	10,000	820,000	861,000
Florida	6,000	540,000	540,000
S. Atlantic	206,000	19,362,000	12,835,000
Ohio	182,000	14,924,000	7,611,000
Indiana	92,000	7,728,000	3,864,000
Illinois	169,000	12,675,000	7,478,000
Michigan	335,000	35,175,000	10,904,000
Wisconsin	260,000	24,700,000	9,386,000
N. C. E. of Miss. River	1,038,000	95,202,000	39,243,000
Minnesota	165,000	10,065,000	6,442,000
Iowa	170,000	12,240,000	7,344,000

State, Territory, or Division.	Acreage.	Production.	Farm value December 1.
	Acres.	*Bushels.*	*Dollars.*
Missouri	92,000	7,912,000	5,380,000
North Dakota	35,000	1,435,000	1,306,000
South Dakota	55,000	2,420,000	2,057,000
Nebraska	110,000	6,600,000	5,544,000
Kansas	88,000	5,016,000	4,514,000
N. C. W. of Miss. River	715,000	45,688,000	32,587,000
Kentucky	41,000	3,772,000	2,339,000
Tennessee	30,000	2,400,000	1,560,000
Alabama	18,000	1,440,000	1,354,000
Mississippi	9,000	765,000	719,000
Louisiana	20,000	1,100,000	990,000
Texas	60,000	3,060,000	3,366,000
Oklahoma	26,000	1,560,000	1,560,000
Arkansas	31,000	2,604,000	2,213,000
S. Central	235,000	16,701,000	14,101,000
Montana	25,000	3,000,000	2,550,000
Wyoming	11,000	1,100,000	902,000
Colorado	65,000	6,500,000	3,575,000
New Mexico	2,000	94,000	98,000
Utah	15,000	2,130,000	1,257,000
Nevada	4,000	600,000	480,000
Idaho	24,000	3,408,000	2,215,000
Washington	39,000	5,109,000	3,730,000
Oregon	44,000	4,620,000	3,234,000
California	62,000	8,060,000	6,851,000
Far Western	291,000	34,621,000	24,892,000
United States	3,591,000	338,811,000	187,985,000

Condition of the potato crop in the United States on the first of months named, 1889–1910.

Year.	July.	Aug.	Sept.	Oct.	Year.	July.	Aug.	Sept.	Oct.
	P. ct.	*P. ct.*	*P. ct.*	*P. ct.*		*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
1889	95.1	94.3	81.7	77.9	1900	91.3	88.2	80.0	74.4
1890	91.7	77.4	65.7	61.7	1901	87.4	62.3	52.2	54.0
1891	95.3	96.5	94.8	91.3	1902	92.9	94.8	89.1	82.5
1892	90.0	86.8	74.8	67.7	1903	88.1	87.2	84.3	74.6
1893	94.8	86.0	71.8	71.2	1904	93.9	94.1	91.6	89.5
1894	92.3	74.0	62.4	64.3	1905	91.2	87.2	80.9	74.3
1895	91.5	89.7	90.8	87.4	1906	91.5	89.0	85.3	82.2
1896	99.0	94.8	83.2	81.7	1907	90.2	88.5	80.2	77.0
1897	87.8	77.9	66.7	61.6	1908	89.6	82.9	73.7	68.7
1898	95.5	83.9	77.7	72.5	1909	93.0	85.8	80.9	78.8
1899	93.8	93.0	86.3	81.7	1910	86.3	75.8	70.5	71.8

POTATOES—Continued.

Acreage, production, value, prices, exports, etc., of potatoes in the United States, 1849–1910.

Year.	Acreage planted and harvested.	Average yield per acre.	Production.	Average farm price per bushel Dec. 1.	Farm value Dec. 1.	Chicago price per bushel, Burbank. December. Low.	December. High.	May of following year. Low.	May of following year. High.	Domestic exports, fiscal year beginning July 1.	Imports during fiscal year beginning July 1.
	Acres.	*Bush.*	*Bushels.*	*Cts.*	*Dollars.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Bushels.*	*Bushels.*
1849 [a]	......	......	65,798,000	......	......	......	......	......	......	155,595	......
1859 [a]	......	......	111,149,000	......	......	......	......	......	......	380,372	......
1866	1,069,000	100.2	107,201,000	47.3	50,723,000	......	......	......	......	512,380	198,265
1867	1,192,000	82.0	97,783,000	65.9	64,462,000	......	......	......	......	378,605	209,555
1868	1,132,000	93.8	106,090,000	59.3	62,919,000	......	......	......	......	508,249	138,470
1869	1,222,000	109.5	133,886,000	42.9	57,481,000	......	......	......	......	596,968	75,336
1870	1,325,000	86.6	114,775,000	65.0	74,621,000	......	......	......	......	553,070	458,758
1871	1,221,000	98.7	120,462,000	53.9	64,905,000	......	......	......	......	621,537	96,259
1872	1,331,000	85.3	113,516,000	53.5	60,692,000	......	......	......	......	515,306	346,840
1873	1,295,000	81.9	106,089,000	65.2	69,154,000	......	......	......	......	497,413	549,073
1874	1,310,000	80.9	105,981,000	61.5	65,223,000	......	......	......	......	609,642	188,757
1875	1,510,000	110.5	166,877,000	34.4	57,358,000	......	......	......	......	704,379	92,148
1876	1,742,000	71.7	124,827,000	61.9	77,320,000	......	......	......	......	529,650	3,205,555
1877	1,792,000	94.9	170,092,000	43.7	74,272,000	......	......	......	......	744,409	528,584
1878	1,777,000	69.9	124,127,000	58.7	72,924,000	......	......	......	......	625,342	2,624,149
1879	1,837,000	98.9	181,626,000	43.6	79,154,000	......	......	......	......	696,080	721,868
1880	1,843,000	91.0	167,660,000	48.3	81,062,000	......	......	......	......	638,840	2,170,372
1881	2,042,000	53.5	109,145,000	91.0	99,291,000	......	......	......	......	408,286	8,789,860
1882	2,172,000	78.7	170,973,000	55.7	95,305,000	......	......	......	......	439,443	2,362,362
1883	2,289,000	90.9	208,164,000	42.2	87,849,000	......	......	......	......	554,613	425,408
1884	2,221,000	85.8	190,642,000	39.6	75,524,000	......	......	......	......	380,868	658,633
1885	2,266,000	77.2	175,029,000	44.7	78,153,000	......	......	33	50	494,948	1,937,416
1886	2,287,000	73.5	168,051,000	46.7	78,442,000	44	47	65	90	434,864	1,432,490
1887	2,357,000	56.9	134,103,000	68.2	91,507,000	70	83	65	85	403,880	8,259,538
1888	2,533,000	79.9	202,365,000	40.2	81,414,000	30	37	24	45	471,955	883,380
1889	2,648,000	77.4	204,881,000	35.4	72,611,000	33	45	30	60	406,618	3,415,578
1890	2,652,000	55.9	148,290,000	75.8	112,342,000	82	93	95	110	341,189	5,401,912
1891	2,715,000	93.7	254,424,000	35.8	91,013,000	30	40	30	50	557,022	186,871
1892	2,548,000	61.5	156,655,000	66.1	103,568,000	60	72	70	98	845,720	4,317,021
1893	2,605,000	70.3	183,034,000	59.4	108,662,000	51	60	64	88	803,111	3,002,578
1894	2,738,000	62.4	170,787,000	53.6	91,527,000	43	58	40	70	572,957	1,341,533
1895	2,955,000	100.6	297,237,000	26.6	78,985,000	18	24	10	23	680,049	175,240
1896	2,767,000	91.1	252,235,000	28.6	72,182,000	18	26	19	26	926,646	246,178
1897	2,535,000	64.7	164,016,000	54.7	89,643,000	50	62	60	87	605,187	1,171,378
1898	2,558,000	75.2	192,306,000	41.4	79,575,000	30	36	33	52	579,833	530,420
1899	2,581,000	88.6	228,783,000	39.0	89,329,000	35	46	27	39	809,472	155,861
1900	2,611,000	80.8	210,927,000	43.1	90,811,000	40	48	35	60	741,483	371,911
1901	2,864,000	65.5	187,598,000	76.7	143,979,000	75	82	58	100	528,484	7,656,162
1902	2,966,000	96.0	284,633,000	47.1	134,111,000	42	48	42	60	843,075	358,505
1903	2,917,000	84.7	247,128,000	61.4	151,638,000	60	66	95	116	484,042	3,166,581
1904	3,016,000	110.4	332,830,000	45.3	150,673,000	32	38	20	25	1,163,270	181,199
1905	2,997,000	87.0	260,741,000	61.7	160,821,000	55	66	48	73	1,000,326	1,948,160
1906	3,013,000	102.2	308,038,000	51.1	157,547,000	40	43	55	75	1,530,461	176,917
1907	3,128,000	95.4	298,262,000	61.8	184,184,000	46	58	50	80	1,203,894	403,952
1908	3,257,000	85.7	278,985,000	70.6	197,039,000	60	77	70	150	763,651	8,383,966
1909	3,525,000	106.8	376,537,000	54.9	206,545,000	20	58	[b] 16	[b] 34	1,001,476	353,208
1910	3,591,000	94.4	338,811,000	55.5	187,985,000	[b] 30	[b] 48	......	......	......	......

[a] Census figures of production. [b] Fair to fancy.

POTATOES—Continued.

Average yield per acre of potatoes in the United States.

State, Territory, or Division.	10-year averages. 1866–1875.	1876–1885.	1886–1895.	1896–1905.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	1909.	1910.
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*
Maine	119	98	110	143	150	130	196	215	175	210	145	225	225	220
New Hampshire	124	95	97	106	108	120	98	135	120	112	120	100	130	150
Vermont	141	110	99	112	90	94	138	128	98	101	120	73	155	130
Massachusetts	116	95	98	98	77	109	96	119	97	114	120	95	125	125
Rhode Island	96	88	102	122	98	164	125	137	125	108	110	150	125	136
Connecticut	99	78	83	94	81	92	96	96	92	98	100	80	120	125
New York	101	79	76	79	78	66	89	93	70	105	98	82	120	102
New Jersey	81	78	77	89	59	132	99	115	93	120	120	72	90	105
Pennsylvania	94	75	73	80	62	83	91	106	90	94	88	72	78	88
North Atlantic	105.3	82.4	81.5	88.3	80.1	85.4	103.0	112.4	91.8	115.2	104.3	95.8	119.9	115.0
Delaware	77	71	61	68	55	79	84	84	93	97	99	82	96	103
Maryland	71	71	68	74	60	80	70	99	95	93	95	77	80	95
Virginia	69	67	67	74	71	75	84	83	84	75	80	88	92	98
West Virginia	78	71	68	78	52	96	80	101	88	97	83	84	98	92
North Carolina	87	72	69	68	64	64	67	78	77	75	88	79	74	89
South Carolina	78	67	68	71	70	69	81	88	83	82	70	81	85	90
Georgia	81	62	65	60	64	58	73	70	65	77	83	78	81	82
Florida	111	69	73	75	62	90	82	102	75	85	80	83	95	90
South Atlantic	75.0	69.4	67.4	72.8	63.1	77.6	77.3	88.7	84.8	84.1	84.9	82.7	88.1	94.0
Ohio	85	74	65	75	54	94	83	98	78	110	76	77	93	82
Indiana	77	69	62	73	31	101	76	93	80	89	87	57	95	84
Illinois	76	79	63	80	35	118	72	108	75	97	87	71	91	75
Michigan	97	85	71	82	81	72	78	121	67	95	90	72	105	105
Wisconsin	89	85	75	92	75	115	58	126	68	97	91	80	102	95
N. Cent. E. of Miss. R.	85.2	78.8	67.6	82.4	62.7	97.7	72.2	113.6	71.9	98.0	87.2	73.4	99.1	91.7
Minnesota	105	100	85	87	68	98	64	102	82	92	101	76	115	61
Iowa	96	88	69	81	32	98	56	136	80	95	85	80	89	72
Missouri	82	78	71	75	17	128	66	96	82	84	82	80	85	86
North Dakota	.....	.....	80	95	110	105	84	111	95	98	89	85	110	41
South Dakota	.....	.....	57	81	45	74	89	96	96	100	84	90	80	44
Nebraska	87	84	60	83	33	137	64	120	93	87	73	78	78	60
Kansas	95	76	59	74	26	138	58	80	81	79	65	80	79	57
N. Cent. W. of Miss. R.	92.7	87.1	69.4	81.3	40.4	111.8	63.6	110.5	84.3	89.7	83.9	79.7	92.1	63.9
Kentucky	70	69	63	67	35	80	73	83	85	82	80	62	92	92
Tennessee	71	72	64	58	46	62	66	71	80	80	85	80	75	80
Alabama	72	71	65	64	67	50	67	61	80	75	95	85	80	80
Mississippi	78	70	66	74	62	69	82	82	110	85	90	91	87	85
Louisiana	85	63	67	64	60	65	50	70	64	62	67	82	75	55
Texas	104	70	66	64	54	66	67	72	64	77	73	71	50	51
Oklahoma	.....	.....	.....	75	59	91	74	77	76	80	70	78	70	60
Arkansas	83	81	71	65	46	72	70	77	65	80	70	82	70	84
South Central	73.6	70.8	64.8	65.4	48.5	71.9	69.3	75.3	75.3	78.4	77.1	75.5	71.0	71.1
Montana	.....	103	102	145	157	153	176	143	120	152	150	138	180	120
Wyoming	.....	94	102	138	113	107	167	161	170	115	200	158	160	100
Colorado	.....	79	91	109	120	100	145	159	160	125	150	125	160	100
New Mexico	.....	75	75	63	50	72	87	62	75	121	100	100	85	47
Utah	.....	96	96	139	114	157	177	137	132	165	100	160	180	142
Nevada	104	97	107	146	141	212	117	131	120	175	200	120	180	150
Idaho	.....	98	110	138	108	149	160	139	140	175	145	130	200	142
Washington	.....	120	120	132	117	136	145	120	142	129	150	120	170	131
Oregon	111	115	91	106	90	103	107	87	110	101	125	99	160	105
California	116	101	81	115	101	118	130	129	165	125	145	107	130	130
Far Western	114.5	103.8	93.3	119.1	110.5	120.4	139.4	130.0	143.3	128.4	143.0	119.7	161.4	119.0
United States	92.9	81.2	73.2	84.4	65.5	96.0	84.7	110.4	87.0	102.2	95.4	85.7	106.8	94.4

POTATOES—Continued.

Average farm value per acre of potatoes in the United States December 1.

State, Territory, or Division.	10-year averages. 1866–1875.	1876–1885.	1886–1895.	1896–1905.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	1909.	1910
	Dolls.	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*
Maine	59.50	53.90	60.50	80.08	100.50	84.50	109.76	103.20	106.75	105.00	81.20	137.25	105.75	92.40
N. Hampshire	63.24	53.20	56.26	66.78	85.32	82.80	63.70	75.60	86.40	67.20	80.42	73.00	83.19	78.00
Vermont	54.99	55.00	48.51	58.24	57.60	54.52	69.00	60.16	69.58	55.55	63.62	48.93	68.20	58.48
Massachusetts	75.40	66.50	67.62	71.54	69.30	88.29	68.16	84.49	81.48	74.10	100.80	80.75	98.76	87.49
Rhode Island	67.20	65.12	71.40	91.50	91.14	123.00	102.50	104.12	111.25	86.40	102.33	129.00	100.00	93.83
Connecticut	66.33	56.16	55.61	67.68	76.14	67.16	74.88	69.12	83.72	70.56	77.00	72.00	99.61	87.49
New York	50.50	42.66	37.24	42.66	55.38	38.94	49.84	50.22	49.00	51.45	55.86	61.50	60.00	48.96
New Jersey	55.08	54.60	46.97	56.96	50.15	80.52	68.31	70.15	69.75	79.20	88.80	64.08	73.80	68.25
Pennsylvania	55.46	42.00	39.42	44.80	47.12	47.31	56.42	57.24	58.50	53.58	58.96	57.60	50.70	45.76
N. Atlantic	56.44	56.66	43.44	50.07	58.90	52.42	61.33	61.23	62.97	62.01	64.98	70.60	67.35	58.16
Delaware	51.59	45.44	32.94	39.44	42.90	40.29	47.04	44.52	54.87	57.23	64.38	68.00	69.11	61.80
Maryland	46.86	44.73	36.04	40.70	46.20	41.60	42.00	50.49	55.10	52.08	57.00	56.97	52.80	51.31
Virginia	38.64	38.19	35.51	42.92	52.54	43.50	53.76	45.65	47.04	50.25	54.39	63.37	64.40	56.84
W. Virginia	43.68	36.92	37.40	44.46	44.20	48.96	52.80	54.54	51.04	59.17	66.41	71.41	66.64	61.63
N. Carolina	52.20	46.80	41.40	44.20	46.08	42.88	49.58	54.60	52.36	55.50	68.65	60.84	59.92	64.96
S. Carolina	73.32	53.60	55.08	70.29	77.00	66.24	84.24	88.88	85.49	86.10	77.00	89.11	97.78	94.50
Georgia	80.19	55.80	54.60	54.60	67.84	52.20	68.62	74.90	72.80	84.70	83.00	85.80	81.00	86.10
Florida	125.43	62.10	67.16	88.50	79.98	109.80	103.32	131.58	90.00	93.50	76.00	112.00	114.00	90.00
S. Atlantic	46 95	41.99	38.62	46.37	51.27	47.11	54.08	54.97	54.65	57.99	62.57	67.48	66.10	62.31
Ohio	51.00	39.22	35.10	38.25	45.90	41.36	50.63	46.06	49.14	52.80	51.68	59.29	52.08	41.82
Indiana	44.66	34.50	34.72	37.23	27.90	41.41	50.16	41.85	46.40	50.73	56.55	47.88	49.40	42.00
Illinois	45.60	41.08	36.54	43.20	32.55	49.56	51.84	50.76	50.25	60.14	62.64	58.93	55.51	44.25
Michigan	48.50	38.25	29.82	31.98	55.08	29.52	38.22	35.09	37.52	32.30	40.50	41.76	36.75	32.55
Wisconsin	43 61	35.70	33.00	34.96	50.25	37.95	33.64	35.28	42.16	29.10	40.95	48.00	38.76	36.10
N. Central E. of Miss. River	47.54	38.38	34.14	36.34	46.11	38.24	42.35	40.29	43.94	41.08	47.52	49.62	43.98	37.81
Minnesota	51.45	36.00	33.15	32.19	45.56	30.38	39.04	29.58	41.00	34.04	41.41	42.56	40.25	39.04
Iowa	43.20	38.72	33.12	35.64	30.08	33.32	42.00	38.08	39.20	40.85	46.75	48.00	48.95	43.20
Missouri	46.74	37.44	34.79	39.75	18.02	44.80	50.16	46.08	45.10	47.88	59.03	59.20	56.95	58.48
N. Dakota	......	......	32.00	34.20	53.90	34.65	40.32	35.52	36.10	45.08	55.19	47.60	49.50	37.31
S. Dakota	......	......	27.93	31.59	38.25	32.56	48.06	28.80	36.48	35.00	42.00	45.91	50.40	37.40
Nebraska	54.81	34.44	32.40	39.01	34.65	36.99	41.60	31.20	34.41	45.24	51.10	42.90	46.80	50.40
Kansas	61.75	48.64	37.17	42.92	27.04	62.10	49.30	44.80	55.89	55.30	57.20	66.40	62.41	51.30
N. Central W. of Miss. River	48.95	39.28	34.21	36.83	33.08	38.53	43.58	36.45	41.36	42.89	49.42	49.89	49.55	45.58
Kentucky	40.60	34.50	35.28	38.19	30.45	42.40	49.64	45.65	45.05	50.02	60.00	50.21	58.88	57.05
Tennessee	41.18	36.72	33.28	36.54	39.56	39.68	42.24	44.02	46.40	49.60	64.59	56.79	53.27	52.00
Alabama	72.72	63.19	53.95	58.24	73.03	46.50	64.32	60.39	70.40	69.75	95.00	80.73	78.41	75.22
Mississippi	71.76	60.90	52.80	64.38	71.30	63.48	72.16	69.70	93.50	73.95	83.67	84.62	82.67	79.89
Louisiana	79.90	53.55	54.94	54.40	60.60	53.30	45.50	63.70	58.24	46.50	60.33	75.46	68.25	49.50
Texas	122.72	67.90	57.42	58.88	67.50	56.10	58.96	66.96	59.52	66.99	76.64	69.58	53.00	56.10
Oklahoma	......	......	......	67.50	73.81	65.23	68.79	58.70	64.86	62.08	70.00	76.44	66.52	60.00
Arkansas	70.55	59.13	44.02	48.10	57.96	48.96	55.30	57.75	47.45	53.60	63.68	70.53	64.39	71.39
S. Central	49.24	42.62	39.72	48.33	52.40	49.68	54.83	55.73	55.43	57.22	69.54	67.12	61.31	60.00
Montana	......	71.07	63.24	75.40	114.61	76.50	77.44	87.23	70.80	92.72	75.00	96.60	91.80	102.00
Wyoming	......	69.56	62.22	86.94	112.40	65.27	95.19	99.82	95.20	74.75	148.00	104.33	100.80	82.00
Colorado	......	65.57	46.41	64.31	108.00	51.00	87.00	58.83	91.20	56.25	99.00	75.00	91.20	55.00
N. Mexico	......	63.00	53.25	54.18	59.00	58.32	73.08	48.36	66.75	108.90	96.00	90.00	86.00	49.00
Utah	......	46.08	42.24	61.16	68.40	70.65	83.19	65.76	56.76	82.50	65.00	88.00	77.40	83.80
Nevada	186.16	92.15	60.99	105.12	128.31	133.56	81.90	85.15	98.40	122.50	180.00	90.00	153.00	120.00
Idaho	......	68.60	58.30	69.00	90.72	55.13	73.60	87.57	67.20	71.75	75.43	78.00	96.00	92.29
Washington	......	60.00	52.80	58.08	71.37	51.68	52.20	67.20	65.32	72.24	75.00	80.39	79.90	95.64
Oregon	75.48	60.95	43.68	54.06	63.00	56.65	53.50	51.33	66.00	56.56	70.00	67.33	96.00	73.50
California	111.36	72.72	45.36	70.15	77.77	68.44	85.80	86.43	110.55	92.50	130.50	82.39	100.10	110.50
Far Western	108.78	68.61	48.52	64.31	84.78	60.17	74.42	69.46	82.56	73.42	93.09	79.48	92.90	85.54
United States	51.00	42.95	37.19	42.12	50.27	45.22	51.99	49.96	53.67	52.29	58.86	60.50	58.59	52.35

POTATOES—Continued.

Average farm price of potatoes per bushel in the United States.

State, Territory, or Division.	Price December 1, by decades.				Price December 1, by years.									Price bimonthly, 1910.					
	1866–1875.	1876–1885.	1886–1895.	1896–1905.	1901	1902	1903	1904	1905	1906	1907	1908	1909	Feb. 1.	Apr. 1.	June 1.	Aug. 1.	Oct. 1.	Dec. 1.
	Cts.	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*
Maine	50	55	55	56	67	65	56	48	61	50	56	61	47	44	30	22	53	40	42
New Hampshire	51	56	58	63	79	69	65	56	72	60	67	73	64	65	47	37	80	55	52
Vermont	39	50	49	52	64	58	50	47	71	55	53	67	44	48	37	23	65	48	45
Massachusetts	65	70	69	73	90	81	71	71	84	65	84	85	79	75	57	55	85	75	70
Rhode Island	70	74	70	75	93	75	82	76	89	80	93	86	80	76	66	58	88	70	69
Connecticut	67	72	67	72	94	73	78	72	91	72	77	90	83	83	70	48	85	70	70
New York	50	54	49	54	71	59	56	54	70	49	57	75	50	52	35	28	65	58	48
New Jersey	68	70	61	64	85	61	69	61	75	66	74	89	82	76	75	60	60	65	65
Pennsylvania	59	56	54	56	76	57	62	54	65	57	67	80	65	63	54	39	61	57	52
N. Atlantic	53.6	56.6	53.3	56.7	73.6	61.4	59.6	54.5	68.6	53.8	62.3	73.7	56.2	55.5	41.9	32.1	63.1	54.7	50.6
Delaware	67	64	54	58	78	51	56	53	59	59	65	83	72	73	62	50	48	52	60
Maryland	66	63	53	55	77	52	60	51	58	56	60	74	66	61	55	46	51	53	54
Virginia	56	57	53	58	74	58	64	55	56	67	68	72	70	73	72	60	54	58	58
West Virginia	56	52	55	57	85	51	66	54	58	61	80	85	68	73	59	45	65	70	67
North Carolina	60	65	60	65	72	67	74	70	68	74	78	77	81	85	95	87	59	67	73
South Carolina	94	80	81	99	110	96	104	101	103	105	110	110	115	112	130	108	89	98	105
Georgia	99	90	84	91	106	90	94	107	112	110	100	110	100	115	120	116	104	101	105
Florida	113	90	92	118	129	122	126	129	120	110	95	135	120	135	130	....	130	108	100
South Atlantic	62.6	60.5	57.3	63.7	81.2	60.7	69.9	62.0	64.5	69.0	73.7	81.6	75.1	79.9	77.1	62.6	64.5	65.1	66.3
Ohio	60	53	54	51	85	44	61	47	63	48	68	77	56	58	42	30	62	72	51
Indiana	58	50	56	51	90	41	66	45	58	57	65	84	52	55	44	35	60	70	50
Illinois	60	52	58	54	93	42	72	47	67	62	72	83	61	65	55	44	65	75	59
Michigan	50	45	42	39	68	41	49	29	56	34	45	58	35	33	22	15	50	55	31
Wisconsin	49	42	44	38	67	33	58	28	62	30	45	60	38	35	27	18	63	67	38
N. C. E. of Miss. River	55.8	48.7	50.5	44.1	73.5	39.1	58.7	35.5	61.1	41.9	54.5	67.6	44.4	44.1	33.2	24.1	58.4	65.0	41.2
Minnesota	49	36	39	37	67	31	61	29	50	37	41	56	35	34	29	23	65	85	64
Iowa	45	44	48	44	94	34	75	28	49	43	55	60	55	59	56	41	76	92	60
Missouri	57	48	49	53	106	35	76	48	55	57	72	74	67	72	70	63	59	70	68
North Dakota	....	....	40	36	49	33	48	32	38	46	62	56	45	52	49	39	70	100	91
South Dakota	....	....	49	39	85	44	54	30	38	35	50	51	63	67	67	57	115	100	85
Nebraska	63	41	54	47	105	27	65	26	37	52	70	55	60	62	61	50	90	100	84
Kansas	65	64	63	58	104	45	85	56	69	70	88	83	79	82	85	76	83	97	90
N. C. W. of Miss. River	52.8	45.1	49.3	45.3	81.8	34.5	68.6	33.0	49.1	47.8	58.9	62.6	53.8	56.2	53.9	44.3	75.6	90.1	71.3
Kentucky	58	50	56	57	87	53	68	55	53	61	75	81	64	70	62	57	56	62	62
Tennessee	58	51	52	63	86	64	64	62	58	62	76	71	71	79	80	77	59	63	65
Alabama	101	89	83	91	109	93	96	99	88	93	100	95	98	105	115	97	89	95	94
Mississippi	92	87	80	87	115	92	88	85	85	87	93	93	95	110	125	102	92	95	94
Louisiana	94	85	82	85	101	82	91	91	91	75	90	92	91	105	100	75	67	78	90
Texas	118	97	87	92	125	85	88	93	93	87	105	98	106	115	115	95	95	115	110
Oklahoma	....	....	....	90	125	71	93	76	85	77	100	98	95	100	104	90	73	110	100
Arkansas	85	73	62	74	126	68	79	75	73	67	91	86	92	100	105	86	74	80	85
South Central	66.9	60.2	61.3	73.9	108.1	69.1	79.2	74.0	73.6	73.0	90.2	88.9	86.3	93.9	94.4	80.8	73.1	85.4	84.4
Montana	....	69	62	52	73	50	44	61	59	61	50	70	51	56	58	42	65	90	85
Wyoming	....	74	61	63	100	61	57	62	56	65	74	66	63	75	80	65	88	94	82
Colorado	....	83	51	59	90	51	60	37	57	45	66	60	57	59	48	30	65	76	55
New Mexico	....	84	71	86	118	81	84	78	89	90	96	90	101	105	110	100	86	120	104
Utah	....	48	44	44	60	45	47	48	43	50	65	55	43	50	55	36	75	58	59
Nevada	179	95	57	72	91	63	70	65	82	70	90	75	85	85	110	90	97	100	80
Idaho	....	70	53	50	84	37	46	63	48	41	52	60	48	60	47	40	63	76	65
Washington	....	50	44	44	61	38	36	56	46	56	50	67	47	55	47	40	60	64	73
Oregon	68	53	48	51	70	55	50	59	60	56	56	68	60	60	58	50	65	80	70
California	96	72	56	61	77	58	66	67	67	74	90	77	77	77	72	80	75	76	85
Far Western	95.0	66.1	52.0	54.0	76.7	50.0	53.4	53.4	57.6	57.2	65.1	66.4	57.6	62.1	57.3	48.2	68.0	76.1	71.9
United States	54.9	52.9	50.8	49.9	76.7	47.1	61.4	45.3	61.7	51.1	61.8	70.6	54.9	56.2	47.4	37.4	64.9	67.8	55.5

POTATOES—Continued.

Wholesale prices of potatoes per bushel, 1897–1910.

Date.	Chicago.		Milwaukee.		St. Louis.		Cincinnati.	
	Burbank, per bushel.		Per bushel.		Burbank, per bushel.		Per bushel.[a]	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*		
1897	18	62	15	100	21	65	$0.90	$4.75
1898	29	87	25	90	30	85	1.25	3.75
1899	26	75	15	90	25	75	1.10	6.00
1900	25	50	20	80	27	54	.32	.57
1901	30	125	25	185	18	140	.30	1.20
1902	30	100	....	....	41	105	.90	3.00
1903	38	85	35	90	40	125	1.20	3.00
1904	31	122	20	120	36	125	1.20	4.80
1905	18	72	10	70	27	175	.25	.80
1906	40	87	25	87	35	125	.45	1.05
1907.								
January	34	45	25	45	43	53	.45	.50
February	37	48	25	45	51	56	.48	.53
March	33	47	25	45	43	55	.50	.53
April	33	61	25	60	63	68	.40	.80
May	55	75	40	70	74	75	.70	.80
June	32	70	30	70	60	78	.60	.70
July	30	50	35	90	50	125	.25	.85
August	....	....	30	90	60	95	.70	.80
September	50	60	45	75	45	72	.60	.85
October	45	65	40	75	55	70	.50	.62
November	45	63	40	65	53	65	.50	.65
December	46	58	40	65	55	64	.50	.65
Year	30	75	25	90	43	125	.25	.85
1908.								
January	52	65	53	75	62	69	.60	.68
February	58	73	65	70	67	77	.65	.82
March	62	75	63	70	71	78	.70	.80
April	60	77	65	80	73	78	.70	.85
May	50	80	58	80	65	74	.60	.85
June	53	150	58	150	100	105	.60	1.35
July	70	110	55	110	....	....	1.10	1.35
August	58	90	60	85	....	....	.85	1.15
September	58	78	60	80	72	72	.75	.85
October	50	81	54	80	67	70	.65	.80
November	57	71	58	70	69	72	.65	.75
December	60	77	64	70	69	75	.65	.80
Year	50	150	53	150	62	105	.60	1.35
1909.								
January	60	79	60	72	73	83	.72	.80
February	65	95	60	88	80	93	.75	.90
March	80	93	70	95	89	98	.85	.95
April	85	110	70	115	92	108	.95	1.15
May	70	150	80	135	85	102	.95	1.00
June	20	145	30	105	40	140	.90	1.20
July	15	125	20	100	40	110	.50	.95
August	38	66	40	90	35	62	.70	.75
September	42	65	45	65	45	72	.55	.70
October	35	55	40	60	42	56	.55	.60
November	15	50	30	50	40	52	.30	.60
December	20	58	30	50	40	50	.30	.48
Year	15	150	20	135	35	140	.30	1.20
1910.	(b)							
January	40	54	25	55	49	62	.35	.50
February	30	48	25	50	39	50	.40	.45
March	20	46	20	45	34	47	.30	.45
April	15	31	18	35	23	35	.30	.35
May	16	34	18	35	32	38	.30	.40
June	10	28	12	35	55	100	.30	.35
July	10	72	12	75	45	72½	.30	.60
August	60	98	55	100	50	80	.55	.65
September	50	98	45	105	50	80	.55	.65
October	35	74	30	70	46	60	.55	.65
November	34	50	30	55	48	54	.45	.52
December	30	48	30	55	47	53	.40	.52
Year	10	98	12	105	23	100	.30	.65

[a] Per barrel for 1897–1899 and 1902–1904.

[b] Fair to fancy.

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POTATOES—Continued.

Average farm price of potatoes per bushel, on the first of each month, 1909–10.

Month.	United States.		North Atlantic States.		South Atlantic States.		N. Cen. States East of Miss. R.		N. Cen. States West of Miss. R.		South Central States.		Far Western States.	
	1910.	1909.	1910.	1909.	1910.	1909.	1910.	1909.	1910.	1909.	1910.	1909.	1910.	1909.
	Cts.	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*
January	56.0	72.0	54.8	74.5	79.1	83.2	45.8	69.4	56.6	64.1	89.8	92.1	60.7	66.9
February	56.2	73.3	55.5	75.4	79.9	77.6	44.1	70.6	56.2	66.9	93.9	87.9	62.1	73.6
March	54.6	80.0	52.6	77.2	83.1	90.3	40.2	77.1	56.7	72.3	99.6	118.2	62.5	83.5
April	47.4	86.3	41.9	82.8	77.1	96.5	33.2	83.2	53.9	81.9	94.4	117.6	57.3	91.1
May	38.4	97.3	34.0	93.6	66.2	101.3	23.2	97.6	44.8	94.2	85.6	119.5	48.3	100.5
June	37.4	97.7	32.1	91.4	62.6	99.9	24.1	94.1	44.3	99.6	80.8	113.4	48.2	115.0
July	40.1	91.0	33.6	91.2	65.4	94.5	27.1	79.5	50.1	91.8	74.9	93.0	52.0	115.1
August	64.9	85.1	63.1	89.1	64.5	79.6	58.4	77.9	75.6	76.8	73.1	77.9	68.0	110.9
September	72.9	71.5	65.2	77.6	63.8	76.7	69.7	59.9	90.6	65.3	79.8	84.2	79.0	81.1
October	67.8	64.3	54.7	65.3	65.1	78.0	65.0	54.0	90.1	61.9	85.4	91.8	76.1	69.1
November	55.7	57.8	45.5	58.5	65.6	76.7	43.4	47.2	74.4	56.2	86.5	89.0	72.9	58.0
December	55.5	54.9	50.6	56.2	66.3	75.1	41.2	44.4	71.3	53.8	84.4	86.3	71.9	57.6

Average yield of potatoes in countries named, bushels per acre, 1900–1909.

Year.	United States.	Russia, European.[a]	Germany.[a]	Austria.[a]	Hungary proper.[a]	France.[b]	United Kingdom.[b]
1900	80.8	104.7	187.5	149.0	131.6	126.0	140.7
1901	65.5	92.2	218.1	155.8	126.8	115.6	216.9
1902	96.0	107.5	199.4	152.4	113.3	114.1	183.7
1903	84.7	91.1	197.0	126.2	125.0	120.2	166.1
1904	110.4	88.4	164.2	126.1	86.2	123.4	195.6
1905	87.0	106.6	216.7	182.5	126.8	142.5	218.8
1906	102.2	94.9	193.3	158.4	128.7	99.5	192.2
1907	95.4	102.4	205.3	173.2	126.6	107.7	171.0
1908	85.7	102.9	209.2	154.0	96.6	163.7	231.1
1909	94.4	111.5	208.9	157.3	125.2	160.3	222.1
Average (1900–1909)	92.0	99.9	200.0	151.1	118.7	133.8	193.8

[a] Bushels of 60 pounds.

[b] Winchester bushels.

HAY.

Acreage, production, value, prices, and exports of hay in the United States, 1849–1910.

Year.	Acreage.	Average yield per acre.	Production.	Average farm price per ton Dec. 1.	Farm value Dec. 1.	Chicago prices No. 1 timothy per ton, by carload lots. December. Low.	December. High.	May of following year. Low.	May of following year. High.	Domestic exports, fiscal year beginning July 1.
	Acres.	*Tons.*[a]	*Tons.*[a]	*Dolls.*	*Dollars.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Tons.*[b]
1849[c]	......	......	13,839,000	......	......	......	......	......	......	......
1859[c]	......	......	19,084,000	......	......	......	......	......	......	......
1866	17,669,000	1.23	21,779,000	10.14	220,836,000	......	......	......	......	5,028
1867	20,021,000	1.31	26,277,000	10.21	268,301,000	......	......	......	......	5,645
1868	21,542,000	1.21	26,142,000	10.08	263,589,000	......	......	......	......	......
1869	18,591,000	1.42	26,420,000	10.18	268,933,000	......	......	......	......	6,723
1870	19,862,000	1.23	24,525,000	12.47	305,743,000	......	......	......	......	4,581
1871	19,009,000	1.17	22,239,000	14.30	317,940,000	......	......	......	......	5,266
1872	20,319,000	1.17	23,813,000	12.94	308,025,000	......	......	......	......	4,557
1873	21,894,000	1.15	25,085,000	12.53	314,241,000	......	......	......	......	4,889
1874	21,770,000	1,15	25,134,000	11.94	300,222,000	......	......	......	......	7,183
1875	23,508,000	1.19	27,874,000	10.78	300,378,000	......	......	......	......	7,528
1876	25,283,000	1.22	30,867,000	8.97	276,991,000	......	......	9.00	10.00	7,287
1877	25,368,000	1.25	31,629,000	8.37	264,880,000	9.50	10.50	9.75	10.75	9,514
1878	26,931,000	1.47	39,608,000	7.20	285,016,000	8.00	8.50	9.00	11.50	8,127
1879	27,485,000	1.29	35,493,000	9.32	330,804,000	14.00	14.50	14.00	15.00	13,739
1880	25,864,000	1.23	31,925,000	11.65	371,811,000	15.00	15.50	17.00	19.00	12,662
1881	30,889,000	1.14	35,135,000	11.82	415,131,000	16.00	16.50	15.00	16.50	10,570
1882	32,340,000	1.18	38,138,000	9.73	371,170,000	11.50	12.25	12.00	13.00	13,309
1883	35,516,000	1.32	46,864,000	8.19	383,834,000	9.00	10.00	12.50	17.00	16,908
1884	38,572,000	1.26	48,470,000	8.17	396,139,000	10.00	11.50	15.50	17.50	11,142
1885	39,850,000	1.12	44,732,000	8.71	389,753,000	11.00	12.00	10.00	12.00	13,390
1886	36,502,000	1.15	41,796,000	8.46	353,438,000	9.50	10.50	11.00	12.50	13,873
1887	37,665,000	1.10	41,454,000	9.97	413,440,000	13.50	14.50	17.00	21.00	18,198
1888	38,592,000	1.21	46,643,000	8.76	408,500,000	11.00	11.50	10.50	11.00	21,928
1889	52,949,000	1.26	66,831,000	7.04	470,394,000	9.00	10.00	9.00	14.00	36,274
1890	50,713,000	1.19	60,198,000	7.87	473,570,000	9.00	10.50	12.50	15.50	28,066
1891	51,044,000	1.19	60,818,000	8.12	494,114,000	12.50	15.00	13.50	14.00	35,201
1892	50,853,000	1.18	59,824,000	8.20	490,428,000	11.00	11.50	12.00	13.50	33,084
1893	49,613,000	1.33	65,766,000	8.68	570,883,000	10.00	10.50	10.00	10.50	54,446
1894	48,321,000	1.14	54,874,000	8.54	468,578,000	10.00	11.00	10.00	10.25	47,117
1895	44,206,000	1.06	47,079,000	8.35	393,186,000	12.00	12.50	11.50	12.00	59,052
1896	43,260,000	1.37	59,282,000	6.55	388,146,000	8.00	8.50	8.50	9.00	61,658
1897	42,427,000	1.43	60,665,000	6.62	401,391,000	8.00	8.50	9.50	10.50	81,827
1898	42,781,000	1.55	66,377,000	6.00	398,061,000	8.00	8.25	9.50	10.50	64,916
1899	41,328,000	1.35	56,656,000	7.27	411,926,000	10.50	11.50	10.50	12.50	72,716
1900	39,133,000	1.28	50,111,000	8.89	445,539,000	11.50	14.00	12.50	13.50	89,364
1901	39,391,000	1.28	50,591,000	10.01	506,192,000	13.00	13.50	12.50	13.50	153,431
1902	39,825,000	1.50	59,858,000	9.06	542,036,000	12.00	12.50	13.50	15.00	50,974
1903	39,934,000	1.54	61,306,000	9.08	556,377,000	10.00	12.00	12.00	15.00	60,730
1904	39,999,000	1.52	60,696,000	8.72	529,108,000	10.50	11.50	11.00	12.00	66,557
1905	39,362,000	1.54	60,532,000	8.52	515,960,000	10.00	12.00	11.50	12.50	70,172
1906	42,476,000	1.35	57,146,000	10.37	592,540,000	15.50	18.00	15.50	20.50	58,602
1907	44,028,000	1.45	63,677,000	11.68	743,507,000	13.00	17.50	13.00	14.00	77,281
1908	46,486,000	1.52	70,798,000	8.98	635,423,000	11.50	12.00	12.00	13.00	64,641
1909	45,744,000	1.42	64,938,000	10.62	689,345,000	16.00	17.00	12.50	16.00	55,007
1910	45,691,000	1.33	60,978,000	12.26	747,769,000	16.00	19.00	......	......	......

[a] 2,000 pounds. [b] 2,240 pounds. [c] Census figures.

HAY—Continued.

Acreage, production, and value of hay in the United States, 1910.

State, Territory, or Division.	Acreage.	Production.	Farm value December 1.
	Acres.	*Tons.*	*Dollars.*
Maine	1,400,000	1,750,000	22,400,000
New Hampshire	640,000	768,000	12,134,000
Vermont	930,000	1,256,000	15,574,000
Massachusetts	590,000	755,000	14,420,000
Rhode Island	63,000	74,000	1,450,000
Connecticut	490,000	662,000	12,578,000
New York	4,811,000	6,351,000	87,009,000
New Jersey	437,000	656,000	11,939,000
Pennsylvania	3,212,000	4,433,000	66,495,000
N. Atlantic	12,573,000	16,705,000	243,999,000
Delaware	77,000	110,000	1,628,000
Maryland	291,000	393,000	6,052,000
Virginia	475,000	565,000	8,192,000
West Virginia	675,000	810,000	12,150,000
North Carolina	175,000	262,000	3,825,000
South Carolina	67,000	84,000	1,344,000
Georgia	87,000	122,000	2,001,000
Florida	19,000	25,000	425,000
S. Atlantic	1,866,000	2,371,000	35,617,000
Ohio	2,840,000	3,948,000	49,350,000
Indiana	2,100,000	2,730,000	32,487,000
Illinois	2,795,000	3,717,000	44,604,000
Michigan	2,592,000	3,370,000	45,832,000
Wisconsin	2,260,000	2,260,000	34,126,000
N. C. E. of Miss. R.	12,587,000	16,025,000	206,399,000
Minnesota	908,000	908,000	8,263,000
Iowa	3,600,000	3,780,000	36,288,000
Missouri	2,700,000	3,510,000	32,292,000
North Dakota	188,000	103,000	783,000
South Dakota	510,000	408,000	2,897,000
Nebraska	1,500,000	1,500,000	13,350,000
Kansas	1,792,000	2,061,000	16,076,000
N. C. W. of Miss. R.	11,198,000	12,270,000	109,949,000
Kentucky	500,000	645,000	8,450,000
Tennessee	455,000	637,000	8,536,000
Alabama	120,000	172,000	2,270,000
Mississippi	100,000	142,000	1,732,000
Louisiana	25,000	44,000	506,000
Texas	618,000	711,000	8,532,000
Oklahoma	900,000	945,000	7,938,000
Arkansas	210,000	284,000	3,124,000
S. Central	2,928,000	3,580,000	41,088,000
Montana	600,000	840,000	10,500,000
Wyoming	300,000	720,000	9,000,000
Colorado	700,000	1,400,000	15,120,000
New Mexico	194,000	407,000	4,680,000
Arizona	116,000	244,000	3,172,000
Utah	380,000	1,140,000	10,260,000
Nevada	231,000	785,000	8,478,000
Idaho	491,000	1,473,000	13,257,000
Washington	388,000	815,000	12,796,000
Oregon	439,000	922,000	11,156,000
California	700,000	1,281,000	12,298,000
Far Western	4,539,000	10,027,000	110,717,000
United States	45,691,000	60,978,000	747,769,000

Average farm price of hay per ton, on the first of each month, 1909–10.

Month.	United States.		North Atlantic States.		South Atlantic States.		N. Central States East of Miss. R.		N. Central States West of Miss. R.		South Central States.		Far Western States.	
	1910.	1909.	1910.	1909.	1910.	1909.	1910.	1909.	1910.	1909.	1910.	1909.	1910.	1909.
	Dolls.	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*
January	11.37	9.09	15.61	12.98	13.98	12.59	11.31	8.54	7.75	5.98	11.28	8.76	11.49	9.29
February	12.35	9.27	16.10	12.99	14.96	12.49	12.12	8.69	9.41	6.12	11.97	8.63	12.34	10.12
March	12.71	9.47	17.21	13.15	15.52	12.57	12.77	8.85	9.18	6.28	12.33	9.10	12.19	10.47
April	12.73	9.65	17.52	12.89	16.30	12.75	12.89	8.93	8.60	6.74	12.61	9.38	12.38	11.02
May	12.21	10.12	17.49	13.16	15.73	12.91	12.00	9.34	7.93	7.36	12.30	9.48	12.07	11.89
June	11.80	10.70	16.26	13.57	15.27	13.05	11.87	10.21	7.91	7.79	12.30	9.72	11.47	12.68
July	11.71	10.50	16.31	14.01	15.13	13.20	11.87	10.00	8.06	7.41	11.62	9.30	10.78	11.67
August	11.29	9.74	13.91	13.83	14.70	13.21	12.14	9.13	8.49	6.42	10.85	8.89	10.47	10.35
September	11.87	9.67	14.51	13.71	14.62	13.07	12.94	9.27	8.88	6.27	10.96	9.44	11.22	9.74
October	11.82	10.03	14.70	14.44	14.69	13.22	12.83	9.55	8.89	6.47	11.10	9.93	10.74	9.99
November	11.96	10.35	15.01	14.67	14.56	13.43	12.98	10.07	9.00	6.78	11.22	10.08	10.75	10.11
December	12.26	10.62	14.61	15.12	15.02	13.87	12.88	10.44	8.96	6.81	11.48	10.92	11.04	10.51

HAY—Continued.

Average yield per acre of hay in the United States.

State, Territory, or Division.	10-year averages. 1866–1875.	1876–1885.	1886–1895.	1896–1905.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	1909.	1910.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Maine	0.87	0.98	0.96	1.04	1.05	1.07	0.98	1.10	1.08	1.20	1.50	0.90	0.95	1.25
N. Hampshire	1.00	.96	.97	1.06	1.28	1.06	.92	1.02	1.16	1.15	1.35	.92	.97	1.20
Vermont	1.05	1.06	1.14	1.28	1.36	1.27	1.18	1.25	1.35	1.20	1.60	1.11	1.25	1.35
Massachusetts	1.10	1.14	1.13	1.29	1.21	1.60	1.36	1.23	1.33	1.31	1.30	1.20	1.15	1.28
Rhode Island	1.04	1.04	.94	1.05	.92	1.03	1.07	1.16	1.09	1.06	1.35	1.50	1.10	1.18
Connecticut	1.23	1.09	1.01	1.11	1.01	1.35	1.11	1.06	1.12	1.17	1.30	1.20	1.15	1.35
New York	1.21	1.16	1.12	1.20	1.30	1.34	1.26	1.36	1.30	1.28	1.25	1.20	1.05	1.32
New Jersey	1.27	1.16	1.17	1.28	1.32	1.22	1.28	1.39	1.13	1.32	1.45	1.60	1.25	1.50
Pennsylvania	1.19	1.21	1.15	1.28	1.19	1.19	1.27	1.45	1.50	1.30	1.45	1.50	1.20	1.38
N. Atlantic	1.15	1.13	1.10	1.21	1.24	1.26	1.21	1.31	1.31	1.26	1.37	1.24	1.10	1.33
Delaware	1.13	1.04	1.13	1.28	1.12	1.09	1.64	1.59	1.55	1.25	1.40	1.60	1.40	1.43
Maryland	1.12	1.10	1.15	1.18	1.22	1.01	1.24	1.36	1.30	1.26	1.40	1.60	1.20	1.35
Virginia	1.19	1.19	1.06	1.20	1.20	1.06	1.30	1.39	1.30	1.25	1.40	1.30	1.30	1.19
W. Virginia	1.16	1.16	1.00	1.34	1.37	1.12	1.38	1.47	1.48	1.40	1.45	1.45	1.25	1.20
N. Carolina	1.29	1.27	1.27	1.51	1.66	1.44	1.60	1.72	1.60	1.54	1.50	1.50	1.38	1.50
S. Carolina	.99	1.17	1.21	1.36	1.46	1.22	1.46	1.53	1.42	1.46	1.50	1.25	1.23	1.25
Georgia	1.25	1.37	1.25	1.50	1.46	1.36	1.53	1.52	1.50	1.65	1.75	1.75	1.35	1.40
Florida	......	......	1.38	1.37	1.48	1.24	1.47	1.36	1.48	1.50	1.35	1.35	1.38	1.33
S. Atlantic	1.17	1.16	1.09	1.30	1.31	1.12	1.37	1.46	1.41	1.36	1.45	1.45	1.28	1.27
Ohio	1.20	1.24	1.17	1.36	1.36	1.43	1.42	1.43	1.49	1.22	1.45	1.53	1.43	1.39
Indiana	1.28	1.32	1.17	1.38	1.27	1.46	1.47	1.37	1.48	1.10	1.35	1.50	1.40	1.30
Illinois	1.36	1.38	1.17	1.36	1.08	1.50	1.54	1.36	1.35	.98	1.40	1.53	1.45	1.33
Michigan	1.22	1.29	1.15	1.33	1.26	1.45	1.37	1.25	1.46	1.28	1.25	1.45	1.30	1.30
Wisconsin	1.34	1.31	1.18	1.53	1.29	1.90	1.89	1.67	1.80	1.35	1.35	1.70	1.53	1.00
N. Central E. of Miss. R.	1.28	1.31	1.17	1.39	1.25	1.53	1.52	1.41	1.50	1.18	1.36	1.54	1.42	1.27
Minnesota	1.47	1.41	1.26	1.66	1.55	1.76	1.84	1.74	1.75	1.70	1.70	1.68	1.75	1.00
Iowa	1.53	1.38	1.19	1.58	1.25	1.68	1.78	1.62	1.70	1.35	1.40	1.70	1.64	1.05
Missouri	1.46	1.28	1.15	1.33	.75	1.59	1.57	1.47	1.10	.78	1.40	1.50	1.35	1.30
N. Dakota	......	......	1.17	1.48	1.60	1.66	1.18	1.57	1.55	1.45	1.30	1.30	1.37	.55
S. Dakota	......	......	1.07	1.34	1.15	1.23	1.45	1.43	1.60	1.50	1.40	1.50	1.50	.80
Nebraska	1.56	1.45	1.13	1.61	1.25	1.74	1.68	1.76	1.75	1.40	1.50	1.55	1.50	1.00
Kansas	1.54	1.38	1.16	1.45	.91	1.70	1.58	1.67	1.55	1.28	1.15	1.50	1.45	1.15
N. Central W. of Miss. R.	1.48	1.37	1.17	1.50	1.08	1.66	1.66	1.60	1.50	1.23	1.40	1.58	1.52	1.10
Kentucky	1.26	1.27	1.17	1.35	1.34	1.44	1.46	1.44	1.30	1.35	1.35	1.35	1.36	1.29
Tennessee	1.32	1.27	1.22	1.49	1.52	1.44	1.58	1.66	1.60	1.51	1.50	1.50	1.50	1.40
Alabama	1.22	1.34	1.44	1.69	1.75	1.50	1.77	1.71	1.90	1.95	1.80	1.60	1.50	1.43
Mississippi	1.27	1.36	1.44	1.62	1.69	1.40	1.74	1.72	1.75	1.90	1.60	1.50	1.47	1.42
Louisiana	1.45	1.17	1.49	1.99	1.85	1.80	2.04	2.06	2.30	1.93	2.00	1.40	1.50	1.75
Texas	1.41	1.31	1.21	1.53	1.25	1.40	1.84	1.77	1.90	1.80	1.30	1.65	.95	1.15
Oklahoma	......	......	1.32	1.35	1.04	1.27	1.36	1.50	1.41	1.40	1.20	1.45	.90	1.05
Arkansas	1.37	1.35	1.20	1.49	1.10	1.60	1.60	1.72	1.75	1.60	1.25	1.50	1.25	1.35
S. Central	1.29	1.27	1.22	1.46	1.33	1.41	1.59	1.61	1.58	1.54	1.37	1.50	1.15	1.22
Montana	......	1.09	1.13	1.64	1.79	1.68	2.08	1.92	1.60	1.85	1.70	2.00	1.79	1.40
Wyoming	......	1.21	1.17	1.86	1.76	1.65	2.14	2.27	2.50	2.25	2.10	2.00	2.40	2.40
Colorado	......	1.18	1.63	2.20	2.08	1.92	2.56	1.85	2.65	2.50	2.70	2.50	2.50	2.00
New Mexico	......	1.14	1.49	2.64	2.31	2.40	2.36	2.58	2.70	2.50	2.05	2.00	2.60	2.10
Arizona	......	1.00	1.47	2.98	2.85	2.34	3.46	2.71	3.75	3.50	2.90	3.20	3.30	2.10
Utah	......	1.30	1.66	2.89	2.45	2.62	2.95	3.54	3.25	4.00	2.10	2.50	2.90	3.00
Nevada	1.41	1.35	1.90	2.60	2.50	2.91	3.12	3.04	2.50	1.50	1.75	2.00	2.35	3.40
Idaho	......	1.21	1.64	2.79	2.58	2.67	2.82	3.07	3.10	2.95	2.40	3.25	2.85	3.00
Washington	......	1.34	1.50	2.20	2.30	2.29	2.41	2.18	2.65	2.38	2.10	2.25	2.10	2.10
Oregon	1.46	1.56	1.52	2.06	2.07	2.04	2.07	2.04	2.30	2.18	2.00	2.00	2.05	2.10
California	1.42	1.47	1.51	1.81	1.82	1.81	2.08	2.03	2.40	1.85	1.75	1.35	1.70	1.83
Far Western	1.43	1.41	1.51	2.09	2.14	2.13	2.45	2.34	2.58	2.43	2.12	2.22	2.29	2.21
United States	1.22	1.25	1.18	1.44	1.28	1.50	1.54	1.52	1.54	1.35	1.45	1.52	1.42	1.33

HAY—Continued.

Average farm price of hay per ton in the United States.

State, Territory, or Division.	Price December 1, by decades.				Price December 1, by years.									Price bimonthly, 1910.					
	1866–1875.	1876–1885.	1886–1895.	1896–1905.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	1909.	Feb. 1.	Apr. 1.	June 1.	Aug. 1.	Oct. 1.	Dec. 1.
	Dolls.	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*
Maine	12.98	11.36	10.62	10.10	10.44	10.04	10.20	9.72	9.90	10.25	12.50	14.00	14.70	16.50	17.10	16.80	12.90	12.50	12.80
New Hampshire	13.34	11.54	11.54	12.66	12.40	13.55	13.26	13.49	13.00	12.50	15.75	16.00	17.90	18.00	19.20	20.00	15.60	15.50	15.80
Vermont	11.52	10.22	9.78	9.54	9.82	9.65	10.88	9.48	9.43	10.00	12.75	13.50	14.70	15.10	16.70	15.20	11.30	12.00	12.40
Massachusetts	19.82	16.58	15.93	15.71	17.49	16.65	16.72	15.76	15.22	17.00	19.00	17.00	18.90	18.80	20.00	19.70	18.20	19.80	19.10
Rhode Island	22.11	17.56	16.47	17.02	19.06	18.89	18.95	17.38	16.27	17.40	19.00	17.25	18.60	21.20	22.50	23.10	21.50	20.30	19.60
Connecticut	19.38	15.68	15.23	14.51	14.62	15.70	15.19	14.89	14.60	15.00	17.00	15.75	19.30	20.00	21.00	20.00	19.00	18.00	19.00
New York	13.49	11.52	10.62	10.34	10.58	10.53	10.96	10.44	10.38	12.10	15.50	12.25	14.20	15.30	16.80	16.10	12.60	14.20	13.70
New Jersey	18.86	15.30	13.31	14.09	14.29	15.64	15.39	14.67	14.81	15.95	17.00	14.00	16.50	18.30	20.50	19.60	16.20	17.50	18.20
Pennsylvania	14.28	11.94	11.10	11.95	13.64	14.00	13.50	11.82	11.93	13.40	15.75	12.00	14.60	15.50	17.10	17.10	14.50	14.80	15.00
North Atlantic	14.29	12.15	11.30	11.37	11.92	12.13	12.31	11.39	11.37	12.64	15.26	13.00	15.12	16.10	17.52	16.26	13.91	14.70	14.61
Delaware	17.38	14.96	12.83	12.62	12.36	14.43	14.83	13.89	13.67	15.00	17.50	12.50	15.00	16.00	18.00	17.00	15.00	14.00	14.80
Maryland	17.02	13.69	11.56	12.35	13.17	14.05	14.02	12.48	11.92	13.50	16.00	12.00	14.40	16.00	17.00	16.00	14.30	14.90	15.40
Virginia	13.43	12.78	11.44	11.70	12.01	13.58	13.73	12.55	12.62	15.50	15.75	12.25	13.30	14.60	16.50	15.00	14.80	14.70	14.50
West Virginia	11.62	9.86	10.34	11.59	13.80	14.33	13.80	12.41	11.65	14.00	15.50	11.00	13.30	14.20	15.20	14.00	14.00	14.10	15.00
North Carolina	10.86	11.11	11.16	11.49	10.80	12.25	13.42	14.56	12.80	15.00	16.50	13.50	14.40	14.70	16.50	16.00	15.50	14.50	14.60
South Carolina	19.54	13.31	11.51	11.36	10.98	11.25	11.72	12.18	13.36	15.25	16.50	14.80	15.50	16.00	17.70	18.10	16.90	17.50	16.00
Georgia	18.37	14.11	12.98	13.55	14.33	13.40	15.15	15.14	15.75	15.75	18.00	14.35	15.80	16.60	17.70	18.00	17.20	16.80	16.40
Florida	15.21	16.74	15.39	15.28	15.35	15.34	18.82	16.67	16.25	15.00	19.00	14.80	15.00	16.10	17.70	18.00	16.80	16.10	17.00
South Atlantic	13.70	12.30	11.29	11.98	12.78	13.70	13.88	12.90	12.49	14.60	16.05	12.14	13.87	14.96	16.30	15.27	14.70	14.69	15.02
Ohio	10.96	9.83	9.42	8.61	8.72	10.20	10.00	9.25	8.00	12.00	11.75	8.70	10.90	12.30	13.00	12.40	11.00	12.40	12.50
Indiana	9.75	8.52	8.77	7.89	9.28	8.67	8.56	8.58	7.54	12.50	12.00	8.80	10.50	12.10	12.20	11.70	10.90	11.70	11.90
Illinois	8.18	7.57	8.11	7.99	11.20	8.87	8.33	8.66	8.27	12.50	11.00	8.20	9.90	12.10	13.00	12.00	10.50	11.80	12.00
Michigan	11.85	10.55	9.82	8.40	8.61	8.30	8.93	9.09	7.70	10.35	12.50	8.75	11.40	13.00	14.50	12.90	12.50	13.20	13.60
Wisconsin	8.67	8.61	8.06	7.62	10.53	7.91	7.50	7.89	7.25	9.00	11.50	8.00	9.60	11.10	11.70	10.30	16.00	15.10	15.10
N. C. E. of Miss. River	9.72	8.79	8.76	8.10	9.56	8.86	8.69	8.72	7.78	11.19	11.73	8.48	10.44	12.12	12.89	11.87	12.14	12.83	12.88

Minnesota	5.37	5.16	4.98	5.22	5.58	5.36	6.61	5.51	5.80	5.50	7.50	5.40	6.00	6.50	6.00	5.80	10.60	10.20	9.10
Iowa	5.38	4.88	5.90	5.45	7.67	6.50	5.46	5.36	5.10	7.00	8.00	5.70	7.10	11.60	9.60	8.40	8.90	9.50	9.60
Missouri	9.02	7.99	7.04	7.00	11.99	6.89	6.68	6.62	7.84	10.00	9.25	7.00	8.30	10.10	10.50	10.00	8.50	8.90	9.20
North Dakota	......	......	4.05	3.93	3.65	3.67	4.64	4.21	4.33	4.50	6.50	4.80	5.00	5.50	5.60	5.10	8.30	7.70	7.60
South Dakota	......	......	4.00	3.76	4.49	4.15	4.63	4.24	4.02	4.50	5.50	4.10	5.10	6.50	5.70	5.30	7.00	7.40	7.10
Nebraska	4.07	3.50	4.29	4.06	6.17	4.36	4.48	3.82	4.14	5.60	6.25	4.90	6.00	7.90	7.30	7.00	8.10	8.50	8.90
Kansas	4.31	4.16	4.40	4.40	7.97	4.31	4.81	4.38	5.08	6.25	7.25	5.70	6.00	7.90	7.60	7.10	7.10	7.60	7.80
N. C. W. of Miss. River	5.68	5.06	5.27	5.01	8.02	5.84	5.73	5.40	5.66	6.88	7.79	5.80	6.81	9.41	8.60	7.91	8.49	8.89	8.96
Kentucky	11.81	10.52	10.40	10.80	12.13	11.30	12.07	11.51	10.63	13.25	13.50	11.00	11.90	13.20	13.30	13.10	12.20	12.40	13.10
Tennessee	14.34	12.04	10.70	11.29	12.31	11.80	12.29	12.01	11.52	13.45	15.00	11.80	12.80	14.30	14.30	15.00	12.80	13.20	13.40
Alabama	16.39	14.22	12.04	11.20	12.07	11.61	12.39	12.13	12.52	13.30	15.25	12.50	13.50	13.70	13.70	15.00	13.50	12.50	13.20
Mississippi	17.13	14.42	10.80	10.09	10.51	10.25	11.60	10.85	11.17	11.45	13.00	11.00	11.50	12.70	13.20	13.10	11.90	11.40	12.20
Louisiana	16.90	13.43	10.24	10.38	11.08	11.72	11.35	12.20	11.50	11.50	15.00	11.00	10.70	11.00	12.10	10.70	10.60	10.40	11.50
Texas	12.02	10.52	8.62	7.79	10.62	8.60	8.20	8.12	8.12	8.50	10.75	8.25	11.90	12.30	13.60	12.00	10.90	11.50	12.00
Oklahoma	......	......	7.88	5.60	7.00	5.26	5.65	4.87	4.96	5.72	6.50	5.00	7.30	8.20	9.50	8.60	7.20	7.60	8.40
Arkansas	14.67	12.57	9.79	9.05	11.72	9.40	9.48	9.82	9.60	9.90	11.75	9.75	10.80	11.60	12.40	12.60	10.30	10.50	11.00
South Central	13.03	11.44	10.02	8.43	11.10	9.71	10.02	9.51	9.15	10.44	12.02	8.57	10.92	11.97	12.61	12.30	10.85	11.10	11.48
Montana	......	10.97	9.82	7.87	8.18	7.54	8.81	8.70	7.70	8.90	9.50	8.35	10.00	12.20	12.70	11.60	11.20	13.20	12.50
Wyoming	......	12.06	8.46	6.60	7.18	7.28	6.67	5.75	6.21	7.75	7.50	7.40	8.90	12.80	9.50	10.00	11.50	13.50	12.50
Colorado	......	15.80	8.49	7.34	9.04	9.89	7.48	6.71	8.20	9.50	9.50	8.75	10.00	11.50	10.60	10.60	10.10	10.20	10.80
New Mexico	......	14.25	10.09	9.54	10.34	11.18	11.12	11.42	10.75	10.75	11.75	9.50	11.10	12.50	14.00	11.10	11.50	12.30	11.50
Arizona	......	14.50	10.03	10.64	9.18	12.23	10.34	14.84	12.37	12.00	14.00	12.20	12.80	14.10	15.00	12.00	12.90	12.20	13.00
Utah	......	6.27	6.67	6.49	8.45	7.32	6.84	6.31	6.67	7.50	7.00	7.40	9.00	10.70	12.00	9.50	7.80	8.20	9.00
Nevada	20.58	12.40	8.27	7.52	7.92	9.05	9.97	7.60	8.50	8.00	10.00	8.80	10.50	12.30	14.50	13.30	12.50	10.30	10.80
Idaho	......	10.75	7.30	5.80	5.91	5.50	6.86	6.08	5.90	8.00	8.50	7.10	9.10	11.50	11.00	11.20	8.30	9.40	9.00
Washington	......	11.00	9.04	9.33	8.52	8.93	12.77	11.34	9.67	11.00	15.00	11.00	14.00	16.00	17.00	17.30	14.80	14.00	15.70
Oregon	12.90	11.22	8.49	7.80	7.16	7.48	10.18	10.18	7.74	7.85	10.25	9.30	11.70	14.90	15.40	12.80	11.00	10.70	12.10
California	16.25	12.14	9.56	9.52	7.92	9.41	11.66	10.41	10.05	11.25	12.50	13.25	11.50	10.80	10.50	9.80	9.40	8.50	9.60
Far Western	16.09	11.78	8.91	8.09	8.02	8.30	9.03	8.26	8.15	9.10	10.24	9.05	10.51	12.34	12.38	11.47	10.47	10.74	11.04
United States	11.56	9.21	8.40	8.07	10.01	9.06	9.08	8.72	8.52	10.37	11.68	8.98	10.62	12.35	12.73	11.80	11.29	11.82	12.26

HAY—Continued.

Average farm value per acre of hay in the United States December 1.

State, Territory, or Division.	10-year averages.				1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	1909.	1910.
	1866–1875.	1876–1885.	1886–1895.	1896–1905.										
	Dolls.	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*
Maine	11.29	11.13	10.20	10.50	10.96	10.74	10.00	10.69	10.69	12.30	18.75	12.60	13.96	16.00
N. Hampshire	13.34	11.08	11.19	13.42	15.87	14.36	12.20	13.76	15.08	14.38	21.26	14.72	17.37	18.96
Vermont	12.10	10.83	11.15	12.21	13.36	12.26	12.84	11.85	12.73	12.00	20.40	14.99	18.38	16.75
Massachusetts	21.80	18.90	18.00	20.27	21.16	26.64	22.74	19.38	20.24	22.27	24.68	20.40	21.74	24.44
Rhode Island	22.99	18.26	15.48	17.87	17.54	19.46	20.28	20.16	17.73	18.44	25.65	25.87	20.40	23.02
Connecticut	23.84	17.09	15.38	16.11	14.77	21.19	16.86	15.78	16.35	17.55	22.10	18.90	22.21	25.67
New York	16.32	13.36	11.89	12.41	13.75	14.11	13.81	14.20	13.49	15.49	19.37	14.70	14.91	18.09
New Jersey	23.95	17.75	15.57	18.04	18.86	19.08	19.70	20.39	16.74	21.05	24.66	22.39	20.62	27.32
Pennsylvania	16.99	14.45	12.76	15.30	15.90	16.66	17.15	17.14	17.90	17.42	22.84	18.00	17.52	20.70
N. Atlantic	16.43	13.73	11.43	13.76	14.72	15.32	14.88	14.94	14.90	15.94	20.91	16.12	16.68	19.41
Delaware	19.64	15.56	14.50	16.15	13.84	15.73	24.32	22.09	21.19	18.75	24.45	20.03	20.96	21.14
Maryland	19.06	15.06	13.29	14.57	16.07	14.19	17.38	16.97	15.50	17.01	22.39	19.20	17.26	20.80
Virginia	15.98	15.21	12.13	14.04	14.41	14.39	17.85	17.44	16.41	19.37	22.06	15.94	17.30	17.25
W. Virginia	13.48	11.44	10.34	15.53	18.91	16.05	19.04	18.24	17.24	19.60	22.48	15.95	16.63	18.00
N. Carolina	14.01	14.11	14.17	17.35	17.93	17.64	21.47	25.04	20.48	23.10	24.69	20.21	19.91	21.86
S. Carolina	19.34	15.57	13.93	15.45	16.03	13.72	17.11	18.64	18.97	22.27	24.89	18.45	19.03	20.06
Georgia	22.96	19.33	16.22	20.32	20.92	18.22	23.18	23.01	23.63	25.99	31.45	25.07	21.25	23.00
Florida	24.49	17.74	21.24	20.93	22.72	19.02	27.67	22.67	24.05	22.50	25.64	20.26	20.53	22.37
S. Atlantic	16.03	14.27	12.31	15.57	16.80	15.41	19.06	18.80	17.61	19.81	23.27	17.60	17.73	19.09
Ohio	13.15	12.19	11.02	11.71	11.86	14.59	14.20	13.23	11.92	14.64	17.05	13.31	15.59	17.38
Indiana	12.48	11.25	10.26	10.89	11.79	12.66	12.58	11.75	11.16	13.75	16.20	13.20	14.70	15.47
Illinois	11.12	10.45	9.49	10.87	12.10	13.31	12.83	11.78	11.16	12.25	15.40	12.55	14.35	15.96
Michigan	14.46	13.61	11.29	11.17	10.85	12.03	12.23	11.36	11.24	13.25	15.62	12.69	14.82	17.68
Wisconsin	11.62	11.28	9.51	11.66	13.58	15.03	14.17	13.18	13.05	12.15	15.53	13.60	14.69	15.10
N. Central E. of Miss. R.	12.44	11.51	10.25	11.26	11.96	13.53	13.22	12.27	11.67	13.25	15.95	13.06	14.84	16.40
Minnesota	7.89	7.28	6.27	8.67	8.65	9.43	12.16	9.59	10.15	9.35	12.75	9.07	10.50	9.10
Iowa	8.23	6.73	7.02	8.61	9.59	10.92	9.72	8.68	8.67	9.45	11.20	9.69	11.64	10.08
Missouri	13.17	10.23	8.10	9.31	8.99	10.96	10.49	9.73	8.62	7.80	12.95	10.50	11.20	11.96
N. Dakota	......	......	4.74	5.82	5.84	6.09	5.48	6.61	6.71	6.52	8.45	6.24	6.86	4.16
S. Dakota	......	......	4.28	5.04	5.16	5.10	6.71	6.06	6.43	6.75	7.70	6.15	7.65	5.68
Nebraska	6.35	5.08	4.85	6.54	7.71	7.59	7.53	6.72	7.24	7.84	9.37	7.59	9.00	8.90
Kansas	6.64	5.74	5.10	6.38	7.25	7.33	7.60	7.31	7.87	8.00	8.34	8.55	8.70	8.97
N. Central W. of Miss. R.	8.41	6.93	6.17	7.52	8.66	9.69	9.53	8.63	8.47	8.47	10.91	9.16	10.35	9.82
Kentucky	14.88	13.36	12.17	14.58	16.25	16.27	17.62	16.57	13.82	17.89	18.22	14.85	16.19	16.90
Tennessee	18.93	15.29	13.05	16.82	18.71	16.99	19.42	19.94	18.43	20.31	22.48	17.70	19.20	18.76
Alabama	20.00	19.05	17.34	18.93	21.12	17.42	21.93	20.74	23.79	25.93	27.45	20.00	20.19	18.92
Mississippi	21.76	19.61	15.55	16.35	17.62	14.35	20.18	18.66	19.55	21.76	20.80	16.57	16.90	17.32
Louisiana	24.50	15.71	15.26	20.66	20.50	21.10	23.15	25.13	26.45	22.20	30.00	15.50	15.83	20.24
Texas	16.95	13.78	10.43	11.92	13.27	12.04	15.09	14.37	15.43	15.30	13.97	13.61	11.30	13.81
Oklahoma	......	......	10.40	7.56	7.29	6.66	7.70	7.33	6.99	8.00	7.79	7.25	6.57	8.82
Arkansas	20.10	16.97	11.75	13.48	12.89	15.04	15.17	16.89	16.80	15.84	14.68	14.63	13.53	14.88
S. Central	16.81	14.53	12.22	12.31	14.72	13.71	15.93	15.29	14.45	16.13	16.47	12.86	12.57	14.03
Montana	......	11.96	11.10	12.91	14.60	12.67	18.32	16.70	12.32	16.46	16.15	16.70	17.90	17.50
Wyoming	......	14.59	9.90	12.28	12.64	12.01	14.27	13.05	15.52	17.44	15.75	14.80	21.36	30.00
Colorado	......	18.64	13.84	16.15	18.80	18.99	19.15	12.41	21.73	23.75	25.65	21.87	25.00	21.60
New Mexico	......	16.24	15.03	25.19	23.89	26.83	26.24	29.46	29.03	26.88	24.09	19.00	28.86	24.12
Arizona	......	14.50	14.74	31.71	26.16	28.62	35.78	40.22	46.39	42.00	40.60	39.09	42.28	27.34
Utah	......	8.15	11.07	18.76	20.70	19.18	20.18	22.34	21.68	30.00	14.71	18.51	26.11	27.00
Nevada	29.02	16.74	15.71	19.55	19.80	29.73	31.11	23.10	21.25	12.00	17.47	17.60	24.70	36.70
Idaho	......	13.01	11.97	16.18	15.25	14.69	19.64	18.67	18.29	23.60	20.39	23.07	25.93	27.00
Washington	......	14.74	13.56	20.53	19.60	20.45	30.78	24.72	25.63	26.18	31.52	24.74	29.40	32.98
Oregon	18.83	17.50	12.90	16.07	14.82	15.26	21.07	20.77	17.80	17.11	20.50	18.60	23.98	25.41
California	23.08	17.85	14.44	17.23	14.41	17.03	24.25	21.13	24.12	20.81	21.88	17.89	19.55	17.57
Far Western	23.01	16.61	13.45	16.91	17.18	17.66	22.16	19.36	21.02	22.11	21.71	20.09	24.11	24.39
United States	14.10	11.51	9.91	11.62	12.85	13.61	13.93	13.23	13.11	13.95	16.89	13.67	15.07	16.37

HAY—Continued.

Wholesale prices of hay (baled) per ton, 1897–1910.

Date.	Chicago.		Cincinnati.		St. Louis.		New York.	
	No. 1 timothy.		No. 1 timothy.		No. 1 timothy.		No. 1 timothy.[a]	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.
1897	$7.50	$9.00	$8.00	$11.50	$8.50	$14.00	$0.72½	$0.90
1898	7.50	10.50	7.50	10.25	7.00	12.50	.65	.80
1899	7.50	13.00	7.75	13.00	8.00	12.00	.65	.95
1900	10.00	14.00	11.50	15.00	9.75	14.50	.87½	.97½
1901	11.50	15.00	11.50	15.50	11.50	17.50	.87½	1.00
1902	10.00	17.50	11.00	16.50	9.50	16.00	17.00	22.00
1903	10.00	15.00	11.50	19.50	9.50	25.00	16.00	26.00
1904	9.00	15.00	11.00	15.50	10.00	13.50	15.00	19.00
1905	10.00	12.50	10.00	13.50	9.00	15.50	14.00	19.00
1906	9.50	18.00	11.00	19.50	11.00	20.00	15.00	23.00
1907.							Per 100 pounds.	
January	14.50	16.50	18.00	19.50	17.00	19.00	1.05	1.10
February	15.00	17.00	18.00	19.00	16.50	19.00	1.05	1.10
March	15.00	17.00	18.50	19.50	16.75	19.00	1.10	1.20
April	15.00	18.00	19.00	20.50	16.50	18.50	1.10	1.20
May	15.50	20.50	19.75	22.75	17.00	20.50	1.15	1.25
June	18.50	21.50	20.00	22.00	18.00	21.50	1.15	1.25
July	17.50	19.00	17.00	21.75	18.00	21.00	1.10	1.20
August	18.00	19.50	14.00	18.50	15.00	24.00	1.15	1.20
September	15.00	19.50	14.50	17.50	15.00	22.00	1.00	1.20
October	14.50	19.00	16.00	17.75	14.00	19.50	1.00	1.15
November	14.50	17.00	14.50	16.75	14.50	18.25	1.05	1.10
December	13.00	17.50	15.00	16.50	14.00	18.00	1.00	1.10
Year	13.00	21.50	14.00	22.75	14.00	24.00	1.00	1.25
1908.							Per ton.	
January	12.50	13.50	14.25	16.50	13.00	18.00	20 00	21.00
February	13.00	13.50	13.75	15.25	13.00	16.50	18.00	20.00
March	12.00	13.50	13.50	15.75	13.00	16.50	19.00	21.00
April	13.00	14.00	13.75	15.00	13.00	16.50	17.00	19.00
May	13.00	14.00	13.00	14.25	14.00	17.00	18.00	19.50
June	10.00	11.00	11.50	12.75	10.50	16.00	16.00	18.00
July	10.00	10.50	12.50	14.00	10.50	16.00	15.00	17.00
August	10.00	11.00	11.50	12.75	10.00	16.00	16.50	18.00
September	10.00	10.50	11.75	13.00	12.00	15.00	14.00	17.00
October	10.00	11.50	12.50	13.50	11.50	13.50	15.00	17.00
November	11.50	12.50	12.50	13.00	11.00	14.50	16.00	16.50
December	11.50	12.00	12.50	14.00	10.50	14.00	17.00	18.00
Year	10.00	14.00	11.50	16.50	10.00	18.00	14.00	21.00
1909.								
January	11.00	12.00	13.25	13.75	12.00	14.00	16.00	17.50
February	11.00	12.00	12.75	13.25	12.00	15.00	16.00	16.50
March	11.00	12.00	12.00	13.75	12.00	15.50	16.00	16.50
April	12.00	13.00	13.50	15.50	12.00	17.00	15.50	17.50
May	12.00	13.00	14.50	16.00	14.50	18.50	17.00	19.00
June	13.00	14.00	14.75	17.00	14.00	17.50	18.50	20.00
July	12.50	13.00	13.00	16.50	15.00	17.50	19.00	20.00
August	14.50	15.00	14.00	14.50	12.00	17.50	19.50	21.00
September	13.00	14.00	14.00	15.50	11.50	15.50	18.00	18.50
October	13.00	14.00	15.00	15.50	13.50	15.50	18.50	18.50
November	13.00	15.50	14.50	16.00	14.00	17.00	18.50	19.00
December	16.00	17.00	16.00	17.25	15.00	17.00	19.50	20.00
Year	11.00	17.00	12.00	17.25	11.50	18.50	15.50	21.00
1910.								
January	16.50	18.50	17.50	19.25	16.00	18.00	21.00	24.00
February	17.00	18.00	18.00	18.75	16.00	18.00	23.00	24.00
March	16.00	18.00	18.00	19.50	16.00	18.50	23.00	24.50
April	15.00	17.00	18.50	19.25	16.00	18.50	22.50	23.00
May	12.50	16.00	17.50	18.75	16.00	18.50	22.50	23.50
June	14.50	17.00	18.50	19.50	16.00	18.50	22.50	23.50
July	16.50	21.00	18.75	22.00	15.00	20.50	24.00	26.00
August	18.00	21.00	17.50	20.00	16.00	19.50	23.00	28.00
September	16.50	18.00	17.00	18.75	16.00	18.50	22.00	23.00
October	16.00	18.50	17.50	20.50	16.00	19.00	22.00	23.00
November	16.00	19.00	17.50	18.50	15.50	18.50	22.00	22.50
December	16.00	19.00	18.00	19.00	16.00	19.50	22.00	22.00
Year	12.50	21.00	17.00	22.00	15.00	20.50	21.00	28.00

[a] Per hundred pounds, 1897 to 1901.

CLOVER AND TIMOTHY SEED.

Wholesale prices of clover and timothy seed, 1897–1910.

Date.	Clover (bushels of 60 pounds).								Timothy.							
	Cincinnati.		Chicago.		Toledo.		Detroit.		Cincinnati.		Chicago.		Milwaukee.		St. Louis.	
	Prime.		Poor to prime.[a]		Poor to choice.[b]				Per bushel (of 45 pounds).		Poor to choice (per 100 pounds).[b]		Per 100 pounds.		Poor to prime (per 100 pounds).	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.
1897	$2.75	$4.50	$1.20	$5.55	$3.10	$5.32½	$3.00	$5.35	$1.15	$1.25	$2.50	$3.10	$2.00	$3.10	.....	.....
1898	2.45	3.75	.60	4.80	2.80	5.15	2.80	5.20	.95	1.25	2.15	3.00	1.50	3.00	.....	.....
1899	2.75	4.50	.90	5.16	3.42½	6.80	3.40	6.50	.95	1.15	2.25	2.55	1.70	2.80	.....	.....
1900	4.00	6.00	2.40	6.30	4.95	7.85	4.80	7.10	1.03	2.00	2.32½	4.65	1.90	4.50	.....	.....
1901	4.50	6.60	2.40	6.90	5.15	7.40	5.15	7.35	1.70	2.90	3.35	6.55	3.00	6.25	.....	.....
1902	4.11	5.76	2.40	6.81	3.90	7.10	4.90	6.10	1.98	3.96	2.00	7.35	2.50	6.75	$2.40	$6.40
1903	5.00	7.10	2.40	7.50	3.05	7.70	6.45	7.50	1.20	1.70	1.75	4.35	2.00	3.75	2.00	3.60
1904	4.80	7.50	3.60	7.80	2.50	7.95	6.20	7.95	1.15	1.35	1.75	3.25	2.00	3.15	2.00	2.80
1905	5.70	7.75	4.80	8.64	3.00	8.85	6.30	8.75	1.15	1.60	1.50	3.75	2.25	3.50	2.00	3.70
1906	4.50	7.50	3.90	8.49	3.00	8.72½	6.25	8.70	1.30	1.85	2.00	4.50	2.40	4.25	2.40	4.00
1907.																
January	7.00	7.50	5.40	8.40	3.00	8.65	8.30	8.60	1.50	1.85	3.25	4.45	3.50	4.25	3.25	4.25
February	7.00	7.50	5.40	8.31	3.00	8.47½	8.00	8.45	1.50	2.00	3.15	4.55	3.50	4.35	3.50	4.45
March	7.00	7.50	5.40	9.45	3.15	9.50	8.00	9.25	1.75	2.00	3.00	4.60	3.50	4.35	3.00	4.45
April	7.00	7.50	4.80	9.30	3.10	9.35	8.45	9.25	1.75	2.00	3.00	4.35	3.40	4.15	3.00	4.00
May	7.00	7.50	4.80	9.15	3.25	9.25	8.75	9.25	1.75	2.25	3.25	4.75	3.25	4.00	3.00	4.05
June	7.00	7.50	5.10	9.15	7.25	9.35	9.00	9.00	1.75	2.00	3.50	4.75	3.75	4.50	3.00	4.00
July	7.00	7.50	5.10	9.30	3.05	9.60	9.00	9.25	1.75	2.00	3.50	4.75	3.75	4.65	3.25	4.25
August	7.50	8.50	5.10	9.75	8.00	10.00	9.00	9.50	1.75	2.15	3.50	4.65	3.50	4.65	3.25	4.50
September	7.50	8.50	5.40	10.05	6.50	10.75	9.00	10.50	1.75	2.15	3.50	4.75	3.50	4.40	3.75	4.60
October	7.50	8.50	6.00	10.20	3.00	11.00	9.50	10.75	1.75	2.15	3.50	4.60	3.80	4.40	3.50	4.50
November	7.50	8.50	5.40	9.90	3.00	9.80	9.35	9.50	1.75	2.15	3.25	4.70	3.50	4.40	3.50	4.30
December	7.50	8.50	5.70	10.20	3.00	10.37½	9.50	10.25	1.75	2.15	3.00	4.35	3.50	4.25	3.50	4.20
Year	7.00	8.50	4.80	10.20	3.00	11.00	8.00	10.75	1.50	2.25	3.00	4.75	3.25	4.65	3.00	4.60
1908.																
January	7.50	10.00	6.00	11.25	6.25	11.40	10.25	11.20	1.75	2.15	4.35	4.55	3.75	4.40	3.50	4.50
February	7.50	10.00	7.20	11.76	6.65	11.77½	11.20	11.60	1.75	2.15	4.60	4.85	3.75	4.60	3.75	4.50
March	7.50	11.00	7.35	13.05	8.50	13.35	11.40	13.00	1.75	2.15	4.50	4.85	3.50	4.30	3.65	4.25
April	8.00	11.00	4.80	14.40	7.00	13.55	11.50	13.00	1.75	2.05	4.25	4.65	2.75	4.10	3.00	4.00
May	8.00	11.00	4.80	10.20	5.50	13.25	12.00	12.50	1.75	2.05	4.10	4.25	2.75	4.00	3.00	3.75
June	8.00	11.00	4.80	10.20	6.00	13.00	.....	.....	1.75	2.05	3.80	4.00	3.00	4.00	3.00	3.75
July	8.00	11.00	4.80	10.20	6.00	13.00	.....	.....	1.75	2.05	3.92½	4.10	3.25	4.00	3.00	3.50
August	5.50	6.00	4.20	10.20	5.20	13.00	.....	.....	1.65	2.05	3.60	3.80	2.85	3.75	3.00	4.00
September	4.50	5.50	4.50	6.00	4.75	5.95	5.50	5.60	1.50	1.65	3.25	3.75	2.50	3.50	2.00	3.50
October	4.00	5.50	3.60	5.70	3.90	5.60	4.60	5.60	1.35	1.65	3.40	3.75	2.50	3.25	2.25	3.35
November	4.00	5.00	3.60	5.70	4.00	5.65	5.00	5.60	1.35	1.55	3.75	4.00	2.50	3.50	2.50	3.35
December	4.00	5.00	3.90	5.67	4.40	5.72½	5.45	5.65	1.35	1.55	3.70	3.85	2.75	3.65	2.50	3.45
Year	4.00	11.00	3.60	14.40	3.90	13.55	4.60	13.00	1.35	2.15	3.25	4.85	2.50	4.60	2.00	4.50
1909.																
January	4.00	5.40	4.20	5.61	5.45	5.70	5.50	5.60	1.35	1.55	2.50	4.00	2.75	3.65	3.00	3.45
February	5.00	5.40	4.50	5.58	5.35	5.60	5.35	5.50	1.35	1.55	2.50	3.90	2.75	3.75	3.00	3.45
March	5.00	5.40	4.20	5.46	5.17½	5.60	5.20	5.45	1.35	1.55	2.50	3.85	2.60	3.80	2.50	3.52
April	5.00	5.40	4.20	5.85	5.55	6.10	5.40	6.10	1.35	1.55	2.50	3.80	2.50	3.80	2.25	3.52
May	5.00	5.40	4.35	5.82	5.70	5.95	5.75	5.85	1.35	1.55	2.50	4.00	2.50	3.75	1.50	3.50
June	5.00	5.40	4.35	6.36	6.00	6.65	6.00	6.10	1.35	1.55	2.50	3.90	2.50	3.75	2.75	3.25
July	5.00	5.40	4.62	6.51	6.50	6.75	.....	.....	1.35	1.55	2.50	3.90	2.50	3.75	2.75	3.25
August	5.00	6.00	4.20	7.02	6.70	7.25	6.65	7.00	1.35	1.55	2.50	3.80	2.50	3.50	2.50	3.70
September	5.80	8.25	4.95	8.25	7.10	9.55	7.00	9.25	1.35	1.65	2.50	4.00	2.50	3.50	2.50	3.55
October	8.00	8.50	5.40	9.00	8.80	9.35	8.85	9.15	1.40	1.65	2.50	4.00	2.50	3.75	2.50	3.60
November	8.00	8.50	5.40	8.70	8.52½	8.95	8.50	8.90	1.30	1.55	2.50	3.75	2.50	3.75	2.50	3.50
December	8.00	8.50	5.70	8.55	8.70	9.22½	8.70	9.15	1.30	1.55	2.50	3.75	2.90	3.60	2.50	3.50
Year	4.00	8.50	4.20	9.00	5.17½	9.55	5.20	9.25	1.30	1.65	2.50	4.00	2.50	3.80	1.50	3.70
1910.																
January	7.98	8.49	9.25	15.00	3.00	9.05	8.50	9.10	1.30	1.55	2.50	3.90	2.90	4.00	2.50	3.65
February	7.50	8.49	9.00	14.05	3.00	8.55	7.90	8.80	1.30	1.65	2.60	3.90	2.90	4.00	2.50	3.65
March	6.00	7.50	7.50	13.60	3.00	8.25	6.90	8.15	1.40	1.65	2.65	3.85	2.90	3.50	3.00	3.50
April	5.49	6.51	6.50	12.50	3.00	7.60	6.75	7.75	1.40	1.65	2.50	3.80	2.75	3.50	3.00	3.50
May	5.49	6.00	6.50	11.25	3.00	6.95	6.40	6.75	1.40	1.65	2.50	3.75	2.75	3.50	3.00	3.50
June	5.49	6.00	6.50	11.50	3.00	7.20	6.75	7.00	1.40	1.65	2.50	4.10	2.75	3.50	3.00	3.75
July	5.49	6.00	6.75	12.85	4.75	8.00	7.00	8.00	1.40	2.25	3.00	5.75	2.75	5.25	3.00	5.50
August	5.49	7.98	8.25	15.50	5.00	9.60	7.85	9.20	2.00	3.50	4.25	8.00	4.25	6.75	5.00	7.65
September	7.74	7.98	9.00	17.00	2.40	10.30	8.75	10.00	3.25	4.25	7.00	9.50	5.50	9.00	7.25	10.00
October	7.74	8.49	8.00	15.50	3.00	9.35	8.50	9.35	3.50	4.25	6.50	9.10	7.00	9.00	5.00	9.00
November	6.99	8.16	8.50	14.30	3.00	9.00	8.40	8.85	3.50	4.00	7.00	9.50	7.50	9.25	5.00	9.25
December	6.99	7.98	8.50	15.00	4.20	9.30	8.75	9.10	3.50	4.00	8.00	9.75	7.25	9.50	5.00	9.50
Year	5.49	8.49	6.50	17.00	2.40	10.30	6.40	10.00	1.30	4.25	2.50	9.75	2.75	9.50	2.50	9.50

[a] Poor to choice, 1897 to 1904.

[b] Prime, 1902 to 1904.

COTTON.

Cotton crop of countries named, 1905–1909.

[No statistics for Siam and some other less important cotton-growing countries. Bales of 500 pounds, gross weight, or 478 pounds, net.]

Country.	1905.	1906.	1907.	1908.	1909.
NORTH AMERICA.					
United States:	*Bales.*	*Bales.*	*Bales.*	*Bales.*	*Bales.*
Contiguous [a]	10,575,017	13,273,809	11,107,179	13,241,799	10,004,949
Noncontiguous—Porto Rico [b]	1,831	220	446	399	240
Total United States (except Philippine Islands)	10,576,848	13,274,029	11,107,625	13,242,198	10,005,189
Guatemala [c]	147	147	147	147	147
Mexico	227,134	270,000	[d] 70,000	[d] 140,000	[d] 90,000
Nicaragua [b]	800	12	[e] 12	[e] 12	[e] 12
Salvador [b]	2	[f] 2	......	......	......
West Indies:					
British—					
Bahamas [b]	14	27	18	27	[g] 25
Barbados	720	1,011	[b] 1,981	[b] 2,061	[b] [g] 1,713
Grenada [b]	445	651	607	489	[g] 677
Jamaica [b]	184	40	13	43	[g] 46
Leeward Islands	[b] 822	[b] 986	1,954	[b] 2,248	[b] [g] 1,504
St. Lucia [b]	3	2	......	......	[g] 13
St. Vincent [b]	289	550	895	880	[g] 773
Trinidad and Tobago	[b] 31	23	24	28	[g] 18
Cuba [b]	21	1	......	......	([h])
French—					
Guadeloupe [b]	5	13	10	26	[i] 26
Martinique [b]	2	1	......	......	......
Haiti [b]	6,878	8,086	7,092	[i] 7,092	7,550
Total	10,814,345	13,555,581	11,190,378	13,395,251	10,107,693
SOUTH AMERICA.					
Argentina	[b] 495	[d] 2,000	[d] 2,000	[j] 2,000	[d] 2,000
Brazil [d]	270,000	365,000	348,000	231,000	277,000
British Guiana [b]	2	1	([h])	......	......
Chile [b]	1,335	1,357	1,134	979	788
Colombia and Venezuela [k]	5,000	5,000	5,000	5,000	5,000
Ecuador [b]	47	[f] 47	34	15	[i] 15
Peru	49,190	58,283	66,804	175,000	212,000
Paraguay [k]	200	200	200	200	200
Total	326,269	431,888	423,172	414,194	497,003
EUROPE.					
Bulgaria	864	874	604	691	[i] 691
Crete [k]	700	700	700	700	700
Greece	[k] 8,200	10,147	[k] 8,200	[k] 8,200	[k] 8,200
Italy [k]	2,700	2,700	2,700	2,700	2,700
Malta	340	348	443	364	[g] 379
Turkey	[d] 7,000	[l] 7,000	[d] 14,000	[m] 14,000	[m] 14,000
Total	19,804	21,769	26,647	26,655	26,670
ASIA.					
British India, including native States [n]	3,921,000	4,487,000	3,591,000	3,997,000	4,297,000
Ceylon [b]	324	559	664	492	[g] 404
China [k]	1,200,000	1,200,000	1,200,000	1,200,000	1,200,000

[a] "Linters," a by-product obtained in the oil mills, not included. Quantity of linters produced as follows: 241,942 in 1904, 229,539 in 1905, 321,689 in 1906, 265,282 in 1907, 343,507 in 1908, and 310,433 in 1909.
[b] Exports.
[c] Official estimate for 1903.
[d] Unofficial estimate.
[e] Exports, 1906.
[f] Exports, 1905.
[g] Preliminary.
[h] Less than one-half bale.
[i] Data for preceding year.
[j] Estimate based upon census returns for acreage.
[k] Average production as unofficially estimated.
[l] Data for 1905.
[m] Data for 1907.
[n] Net exports and consumption.

COTTON—Continued.

Cotton crop of countries named, 1905–1909—Continued.

Country.	1905.	1906.	1907.	1908.	1909.
ASIA—continued.	*Bales.*	*Bales.*	*Bales.*	*Bales.*	*Bales.*
Cyprus	1,637	3,361	4,110	3,860	a 2,533
Dutch East Indies b	13,280	15,944	19,652	19,932	2,990
French India b	14	......	......	......	......
French Indo-China b	18,103	11,082	15,877	20,968	18,201
Japan	12,370	9,238	8,195	6,437	c 6,437
Korea d	70,000	70,000	70,000	70,000	70,000
Persia b	81,931	91,431	89,689	83,985	128,031
Philippine Islands e	6,098	6,098	6,098	6,098	6,098
Russia, Asiatic:					
Central Asia f	486,000	627,063	486,192	494,000	497,000
Transcaucasia	53,000	60,440	62,553	52,000	46,000
Total Asiatic Russia	539,000	687,503	548,745	546,000	543,000
Turkey, Asiatic g	d 60,000	d 60,000	h 94,000	h 92,000	c 92,000
Total	5,923,757	6,642,216	5,648,030	6,046,772	6,366,694
AFRICA.					
British Africa:					
Nyasaland Protectorate b	1,625	1,101	844	1,582	a 1,797
East Africa	208	214	167	526	a 297
Gambia b	5	......	......	......	......
Gold Coast b	61	194	117	108	a 65
Natal	h 31	42	b 40	(i)	(i)
Nigeria—					
Colony of Lagos b	2,675	5,640	8,556		
Southern Protectorate b	201			4,800	a 10,529
Northern Protectorate b	258	745	......		
Uganda b	201	819	4,024	3,401	a 10,103
Sierra Leone b	144	184	27	1	......
Union of South Africa b	......	......	......	82	a 159
Total British Africa	5,409	8,939	13,775	10,500	22,950
Egypt	1,230,641	1,427,774	1,486,387	1,398,125	a 1,000,000
French Africa: b					
Algeria	......	8	73	163	2
Dahomey	h 84	......	428	342	c 342
Madagascar	11	333	1	4	c 4
Senegal	5	97	110	75	c 75
Upper Senegal and Niger				62	c 62
Somali Coast	106	9	7	3	c 3
Total French Africa	206	447	619	649	488
German Africa: b					
East Africa	871	870	1,068	1,246	2,395
Kamerun	......	2	......	11	......
Toga	618	892	1,297	1,933	2,355
Total German Africa	1,489	1,764	2,365	3,190	4,750
Italian Africa—Eritrea	62	......	370	890	553
Belgian Kongo b	1	1	3	1	(j)
Portuguese Africa:					
Angola k	492	256	425	241	c 241
East Africa	26	c 26	b 6	......	48
Total Portuguese Africa	518	282	431	241	289
Sudan (Anglo-Egyptian)	19,441	17,782	28,558	24,170	c 24,170
Total Africa	1,257,767	1,456,989	1,532,508	1,437,766	1,053,200

a Preliminary.
b Exports.
c Data for preceding year.
d Average production as unofficially estimated.
e Census, 1902.
f Including Khiva and Bokhara.
g Anatolia and Adana only.
h Unofficial estimate.
i Included in British South Africa.
j Less than one-half bale.
k Imports from Angola into Portugal.

COTTON—Continued.

Cotton crop of countries named, 1905–1909—Continued.

Country.	1905.	1906.	1907.	1908.	1909.
OCEANIA.					
	Bales.	*Bales.*	*Bales.*	*Bales.*	*Bales.*
British—Queensland	79	54	76	82	a 90
French: b					
New Caledonia	(c)	....	....	3	d 3
French Establishments	39	110	109	70	332
German—Bismarck Archipelago b	15	38	5	....	....
Total Oceania	133	202	190	155	425
Grand total	18,342,075	22,108,645	18,820,925	21,320,793	18,051,685

a Preliminary. b Exports. c Less than one-half bale. d Data for preceding year.

Cotton acreage (harvested), by States, 1905–1910.

[As reported by Bureau of Statistics, Department of Agriculture.]

State or Territory.	1905.	1906.	1907.	1908.	1909.	1910.a
	Acres.	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*
Virginia	38,664	36,000	35,000	28,000	25,000	29,000
North Carolina	1,085,568	1,374,000	1,408,000	1,458,000	1,359,000	1,418,000
South Carolina	2,161,923	2,389,000	2,426,000	2,545,000	2,492,000	2,513,000
Georgia	3,738,703	4,610,000	4,774,000	4,848,000	4,674,000	4,833,000
Florida	256,173	283,000	265,000	265,000	237,000	254,000
Alabama	3,500,168	3,658,000	3,439,000	3,591,000	3,471,000	3,552,000
Mississippi	3,051,265	3,408,000	3,220,000	3,395,000	3,291,000	3,207,000
Louisiana	1,561,774	1,739,000	1,622,000	1,550,000	930,000	956,000
Texas	6,945,501	8,894,000	9,156,000	9,316,000	9,660,000	10,094,000
Arkansas	1,718,751	2,097,000	1,950,000	2,296,000	2,218,000	2,229,000
Tennessee	757,397	814,000	749,000	754,000	735,000	737,000
Missouri	66,444	91,000	71,000	87,000	79,000	84,000
Oklahoma	418,184	1,080,000	2,196,000	2,311,000	1,767,000	2,208,000
Indian Territory	816,638	901,000				
California	....	....	....	....	....	15,000
United States	26,117,153	31,374,000	31,311,000	32,444,000	30,938,000	32,129,000

a Preliminary.

Production of lint cotton (excluding linters), in 500-pound gross weight bales, by States and total value of crop, 1905 to 1910.

[As finally reported by U. S. Bureau of the Census, except 1910, which are preliminary estimates of Department of Agriculture.]

State or Territory.	1905.	1906.	1907.	1908.	1909.	1910.
	Bales.	*Bales.*	*Bales.*	*Bales.*	*Bales.*	*Bales.*
Virginia	14,913	13,862	9,223	12,326	10,095	13,000
North Carolina	619,141	579,326	605,310	646,958	600,606	675,000
South Carolina	1,078,047	876,181	1,119,220	1,170,608	1,099,955	1,116,000
Georgia	1,682,555	1,592,572	1,815,834	1,931,179	1,804,014	1,750,000
Florida	68,797	55,945	49,794	62,089	54,011	58,000
Alabama	1,238,574	1,261,522	1,112,698	1,345,713	1,024,350	1,174,000
Mississippi	1,198,572	1,530,748	1,468,177	1,655,945	1,083,215	1,160,000
Louisiana	513,480	987,779	675,428	470,136	253,412	260,000
Texas	2,541,932	4,174,206	2,300,179	3,814,485	2,522,811	3,140,000
Arkansas	619,117	941,177	774,721	1,032,920	713,463	815,000
Tennessee	278,637	306,037	275,235	344,485	246,630	305,000
Missouri	42,730	54,358	36,243	61,907	45,141	48,000
Oklahoma	326,981	487,306	862,383	690,752	544,954	900,000
Indian Territory	350,125	410,520				
All other	1,416	2,270	2,734	2,296	2,292	a 12,000
United States	10,575,017	13,273,809	11,107,179	13,241,799	10,004,949	11,426,000
Total value of crop	$556,830,000	$640,310,000	$613,630,000	$588,810,000	$688,350,000	....

a California.

COTTON—Continued.

Condition of the cotton crop in the United States, monthly, and average yield per acre, 1889–1910.

Year.	June.	July.	August.	September.	October.	Average yield per acre (lint).	Year.	June.	July.	August.	September.	October.	Average yield per acre (lint).
	P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*Lbs.*		*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*Lbs.*
1889	86.4	87.6	89.3	86.6	81.5	158.8	1900	82.5	75.8	76.0	68.2	67.0	194.4
1890	88.8	91.4	89.5	85.5	80.0	187.0	1901	81.5	81.1	77.2	71.4	61.4	169.0
1891	85.7	88.6	88.9	82.7	75.7	179.4	1902	95.1	84.7	81.9	64.0	58.3	188.5
1892	85.9	86.9	82.3	76.8	73.3	209.2	1903	74.1	77.1	79.7	81.2	65.1	174.5
1893	85.6	82.7	80.4	73.4	70.7	148.8	1904	83.0	88.0	91.6	84.1	75.8	204.9
1894	88.3	89.6	91.8	85.9	82.7	191.7	1905	77.2	77.0	74.9	72.1	71.2	186.1
1895	81.0	82.3	77.9	70.8	65.1	155.6	1906	84.6	83.3	82.9	77.3	71.6	202.5
1896	97.2	92.5	80.1	64.2	60.7	124.1	1907	70.5	72.0	75.0	72.7	67.7	178.3
1897	83.5	86.0	86.9	78.3	70.0	181.9	1908	79.7	81.2	83.0	76.1	69.7	194.9
1898	89.0	91.2	91.2	79.8	75.4	219.0	1909	81.1	74.6	71.9	63.7	58.5	154.3
1899	85.7	87.8	84.0	68.5	62.4	184.1	1910	82.0	80.7	75.5	72.1	65.9	169.9

Average yield per acre of cotton in the United States.

State.	10-year averages.				1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	1909.	1910.[a]
	1866–1875.	1876–1885.	1886–1895.	1896–1905.										
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
Virginia	175	169	156	173	176	248	180	204	204	185	190	210	190	212
North Carolina	171	175	171	199	142	236	210	233	240	201	205	211	210	227
South Carolina	150	152	158	186	141	199	178	215	220	175	215	219	210	212
Georgia	150	147	152	171	167	165	158	205	200	165	190	190	184	174
Florida	140	107	125	122	117	120	142	140	144	95	115	112	110	110
Alabama	149	141	150	162	156	144	161	182	173	165	169	179	142	158
Mississippi	177	175	182	200	205	220	211	220	190	215	228	233	157	173
Louisiana	208	206	211	235	260	262	223	265	170	272	210	145	130	130
Texas	236	192	198	169	159	148	143	183	164	225	130	196	125	149
Arkansas	216	221	214	206	173	268	196	205	172	215	195	215	153	175
Tennessee	170	188	165	182	136	252	200	202	212	180	190	218	158	198
Missouri	232	204	224	213	196	352	232	270	294	285	275	340	271	275
Oklahoma	......	......	150	228	206	257	228	248	215	217	200	143	147	195
California	......	......	......	......	......	......	......	......	......	......	......	......	......	390
United States	176.4	171.4	175.9	182.6	169.0	188.5	174.5	204.9	186.1	202.5	178.3	194.9	154.3	169.9

[a] Preliminary.

Average farm price of cotton per pound, on the first of each month, 1909–1910.

Month.	United States.		North Atlantic States.		South Atlantic States.		N. Cen. States East of Miss. R.		N. Cen. States West of Miss. R.		South Central States.		Far Western States.	
	1910.	1909.	1910.	1909.	1910.	1909.	1910.	1909.	1910.	1909.	1910.	1909.	1910.	1909.
	Cts.	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*
January	14.6	8.4	......	......	14.9	8.6	......	......	14.1	8.5	14.4	8.3	......	......
February	14.0	9.0	......	......	14.2	9.3	......	......	14.0	8.7	13.9	8.9	......	......
March	14.0	9.0	......	......	14.3	9.3	......	......	14.2	9.0	13.8	8.9	......	......
April	14.1	9.1	......	......	14.5	9.3	......	......	13.0	9.1	13.9	9.0	......	......
May	14.0	9.6	......	......	14.3	10.0	......	......	......	9.2	13.8	9.5	......	......
June	14.2	10.1	......	......	14.6	10.6	......	......	13.3	......	13.9	9.9	......	......
July	13.9	10.3	......	......	14.2	10.9	......	......	12.1	9.2	13.7	10.1	......	......
August	14.3	11.3	......	......	14.8	11.9	......	......	......	10.0	14.0	11.1	......	......
September	14.4	11.7	......	......	14.8	12.0	......	......	12.7	......	14.2	11.6	......	......
October	13.3	12.6	......	......	13.4	12.7	......	......	13.5	11.9	13.2	12.5	12.5	......
November	14.0	13.7	......	......	14.0	14.0	......	......	12.5	12.9	14.0	13.6	14.0	......
December	14.2	13.9	......	......	14.3	14.1	......	......	13.0	13.5	14.1	13.8	13.3	......

COTTON—Continued.

Closing prices of middling upland cotton per pound, 1897–1910.

Date.	New York.		New Orleans.		Memphis.		Galveston.		Savannah.		Charleston.		Wilmington.		Norfolk.	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.
	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.
1897	5 13/16	8 1/4	5 1/4	7 13/16	5 1/4	7 13/16	5 3/8	7 11/16	5 1/8	7 3/4	5 1/8	7 3/4	5	8 1/8	5 3/8	8 1/8
1898	5 5/16	6 7/8	4 3/4	6 1/16	4 7/8	6	4 7/8	6 1/16	4 1/2	6	4 9/16	6	4 3/4	6 1/4	4 15/16	6 3/8
1899	6 1/8	7 13/16	5 3/16	7 1/2	5 3/8	7 1/2	5 7/16	7 1/2	5 1/16	7 5/16	5 1/8	7 3/8	5 3/8	7 1/2	5 3/8	7 1/2
1900	7 1/4	11	7 1/4	11 1/8	7 3/8	11	7 1/4	10	7 5/16	10 3/4	7 1/4	10 3/4	7 1/8	10 3/4	7 7/16	11
1901	7	12	7 1/4	9 11/16	7 1/8	9 5/8	7 3/8	9 11/16	7 1/8	9 5/8	7 1/8	9 7/8	7 1/8	9 1/2	7 1/4	9 11/16
1902	8 3/16	9 7/8	7 5/8	9 3/4	7	9 1/2	7 3/4	9 5/8	7 9/16	9 9/16	7 3/16	9 3/8	7 3/4	9 3/8	7 3/4	9 3/4
1903	8.85	14.10	8 7/16	13 5/8	8 1/2	13 1/2	8 5/8	13 3/8	8 3/8	13 3/8	8 1/4	13 1/2	8 1/4	12 3/4	8 5/8	13 3/4
1904	6.85	17.25	6 1/2	16 7/16	6 3/4	16 1/2	6 5/8	16	6 1/2	16 1/4	6 1/2	16	9	15 3/4	6 3/4	16 1/2
1905	7.00	12.60	6 5/8	12 1/16	6 3/4	12 1/8	6 3/4	12	6 5/8	11 11/16	6 5/8	11 5/16	6 3/4	11 3/8	6 3/4	12
1906	9.60	12.25	9 3/8	11 11/16	9 3/8	11 11/16	9 1/4	11 9/16	8 7/8	11 3/4	8 3/4	11 3/8	9	11 1/4	9 3/8	11 3/4
1907.																
January	10.70	11.00	10 1/4	10 9/16	10 1/4	10 9/16	10 1/2	10 11/16	9 7/8	10 9/16	9 3/4	10	9 7/8	10 3/16	10 1/4	10 5/8
February	11.00	11.25	10 1/2	10 9/16	10 7/16	10 9/16	10 3/4	11 1/16	10 1/8	10 5/16	10	10 3/16	10 1/8	10 3/8	10 1/2	10 7/8
March	10.90	11.45	10 5/8	11 1/16	10 3/8	10 11/16	10 13/16	11 7/16	10 3/8	10 5/8	10 3/8	10 5/8	10 3/8	10 5/8	11	11 1/4
April	10.90	11.45	10 1/2	11 3/16	10 1/2	11 1/8	10 7/8	11 5/8	10 1/4	11	10 1/4	10 3/4	10 3/8	10 7/8	11	11 7/8
May	11.50	12.90	11 1/2	12 7/16	11 1/4	12 1/2	11 7/8	12 3/4	11	12 1/8	11	11 7/8	11	12 1/4	12	13 1/4
June	12.80	13.25	12 1/2	13	12 1/2	12 15/16	12 3/4	13 1/16	12 1/4	12 3/4	....	....	12 1/4	12 1/4	13 1/4	13 1/2
July	12.85	13.50	12 5/8	13 1/8	12 15/16	13 3/16	12 7/8	13 1/8	12 7/8	13 1/8	....	....	....	....	13 1/2	13 5/8
August	13.00	13.55	12 5/8	13 9/16	13	13 1/2	....	....	12 5/8	13 3/16	....	....	....	....	13 1/2	13 1/2
September	11.75	13.55	11 1/2	13 9/16	11 7/8	13 1/2	12 1/8	13 9/16	11 1/8	13 5/16	11 1/8	13	11 1/4	13	11 3/4	13 1/2
October	10.80	12.00	10 3/8	11 7/16	10 3/4	12	11	12 1/8	10	11 5/16	10	11 5/16	10	11 3/16	10 3/8	11 7/8
November	10.60	11.80	10 1/2	11 5/16	10 3/4	11 1/4	10 7/8	11 3/16	10 1/4	10 7/16	10 1/8	10 7/16	10 1/4	10 7/16	10 1/2	11 1/4
December	11.70	12.20	11 1/8	11 13/16	11 3/8	11 3/4	11 1/2	12	10 1/2	11 7/16	10 3/4	11 1/16	10 13/16	11 1/16	11 1/8	11 9/16
Year	10.60	13.55	10 1/4	13 9/16	10 1/4	13 1/2	10 1/2	13 9/16	9 7/8	13 5/16	9 3/4	13	9 7/8	13	10 1/4	13 5/8
1908.																
January	11.30	12.25	11 3/8	12 1/4	11 1/2	12 3/8	11 3/8	12 1/4	10 9/16	11 5/8	10 5/8	11 1/2	10 13/16	11 3/4	11 1/8	12 1/4
February	11.35	11.85	11 3/8	11 7/8	11 5/8	11 15/16	11 3/8	11 7/8	11	11 3/8	11	11 1/4	11 1/8	11 1/2	11 5/8	12 1/8
March	10.40	11.65	10 1/2	11 3/8	10 3/4	11 5/8	10 1/2	11 7/16	10 1/8	11 1/8	10	11	10 1/8	11 1/4	10 3/8	11 3/4
April	9.90	10.50	9 13/16	10 1/2	9 3/4	10 3/4	9 3/4	10 1/2	9 3/4	10 7/8	11	11	9 3/4	10 1/8	10 1/4	10 1/2
May	10.20	11.50	9 15/16	11 1/2	10	11 5/8	10 3/8	11 3/4	9 3/4	11 1/2	9 3/4	11 1/2	9 7/8	11 1/2	10	11 5/8
June	11.30	12.20	11 3/8	11 7/8	11 1/2	11 3/4	11 9/16	11 7/8	11 1/8	11 5/8	11	11 5/8	11 1/8	11 5/8	11 1/2	12
July	10.70	11.50	10 3/8	11 3/8	10 1/2	11 5/8	10 1/4	11 3/8	10 3/8	11 1/8	10 3/8	11	10 7/8	11 1/8	11	12
August	9.50	10.85	9 1/8	10 3/8	9 5/8	10 1/2	9 1/8	10 7/16	9	10 1/2	9	10 1/2	Nominal.		10	11
September	9.30	9.60	9	9 3/16	9 1/8	9 5/8	9 1/16	9 7/16	8 3/4	9 1/8	8 3/4	9	8 7/8	9 1/16	9 1/8	9 3/8
October	9.00	9.45	8 3/4	9	8 7/8	9 1/8	9	9 3/16	8 1/2	8 15/16	8 1/2	8 15/16	8 1/2	8 7/8	8 3/4	9 3/8
November	9.25	9.55	8 7/8	9 1/16	9 1/8	9 1/4	9	9 3/16	8 3/4	9	8 3/4	8 15/16	8 3/4	8 7/8	9	9 3/16
December	9.10	9.35	8 11/16	8 15/16	8 3/4	9 1/8	8 3/4	9	8 1/4	8 11/16	8 1/4	8 3/4	8 1/4	8 11/16	8 3/4	9 1/16
Year	9.00	12.25	8 11/16	12 1/4	8 3/4	12 3/8	8 3/4	12 1/4	8 1/4	11 5/8	8 1/4	11 5/8	8 1/4	11 3/4	8 3/4	12 1/4
1909.																
January	9.25	10.00	8 7/8	9 5/8	9	9 1/2	9	9 7/8	8 11/16	9 9/16	8 3/4	9 5/16	9	9 1/2	....	....
February	9.65	10.00	9 5/16	9 1/2	9 5/16	9 3/8	9 7/16	9 3/4	9 3/16	9 7/16	9	9 3/16	9	9 5/8	....	....
March	9.60	9.85	9 1/4	9 1/2	9 5/16	9 7/16	9 3/8	9 9/16	9 1/16	9 5/16	9	9 3/16	9	9 3/8	....	....
April	9.95	10.90	9 7/16	10 5/16	9 3/4	10 1/4	9 9/16	10 3/8	9 3/16	10 1/16	9 1/4	10 1/16	9 3/8	10 1/4	....	....
May	10.85	11.80	10 3/16	11	10 3/16	10 7/8	10 3/8	10 7/8	10 1/16	10 7/8	10	10 13/16	10 1/8	10 7/8	....	....
June	11.20	12.00	10 7/8	11 1/2	10 7/8	11 3/8	10 5/8	11 1/4	10 3/4	11 3/8	....	....	10 3/4	11 1/4	....	....
July	12.10	13.15	11 1/2	12 5/8	11 7/16	12 3/8	11 3/8	12 1/2	11 3/8	12 5/8	....	....	11 1/4	12 3/16	....	....
August	12.40	13.10	12 1/8	12 1/2	12	12 3/8	12	12 3/8	12	12 1/2	....	....	12 1/8	12 1/4	....	....
September	12.40	13.75	12 3/16	13 3/16	12 3/8	13 1/4	12 3/16	13 3/16	12	13 1/16	11 7/8	13	12 1/8	13	....	....
October	13.30	15.05	13	14 7/16	13 1/4	14 3/4	13	14 7/16	12 3/4	14 3/8	12 1/4	14 3/16	13	14 1/8	....	....
November	14.20	15.20	14 1/8	14 11/16	14 5/8	15	13 7/8	14 5/8	13 3/4	14 5/8	14	14 5/16	13 3/4	14 1/4	....	....
December	14.65	16.15	14 1/4	15 3/4	14 5/8	15 5/8	14 1/4	15 3/4	14 1/8	15 7/8	14 1/2	15 3/16	14	15 3/8	....	....
Year	9.25	16.15	8 7/8	15 3/4	9	15 5/8	9	15 3/4	8 11/16	15 7/8	8 3/4	15 3/16	9	15 3/8	....	....
1910.																
January	13.85	16.10	14 7/8	15 3/4	15 1/4	15 5/8	14 3/4	15 3/4	14 5/8	15 1/2	15 1/4	15 5/8	....	....	....	....
February	14.10	15.25	14 5/8	15 1/16	15	15 3/8	14 3/4	15	14 5/8	15 1/16	14 3/8	15	....	....	....	....
March	14.65	15.35	14 9/16	14 3/16	15	15	14 3/4	14 7/8	14 11/16	14 3/4	14 5/8	14 3/4	....	....	....	....
April	14.55	15.30	14 9/16	14 13/16	14 3/4	14 7/8	14 7/16	14 3/4	14 1/2	14 3/4	14	14 3/4	....	....	....	....
May	14.50	16.05	14 5/8	15 1/8	14 7/8	15 1/8	14 5/8	15 1/8	14 1/2	15 1/8	14 3/8	15	....	....	....	....
June	14.50	15.40	14 1/2	15	14 7/8	15	14 1/2	15	14 5/8	14 7/8	....	....	....	....	....	....
July	15.25	16.45	14 5/8	15 3/16	14 7/8	15 1/8	14 5/8	15 7/8	14 13/16	15 3/8	....	....	....	....	....	....
August	15.20	19.75	14 5/8	15 1/4	15	15 5/8	14 3/8	15 1/8	14 3/8	15 1/2	....	....	....	....	....	....
September	13.60	15.50	13 1/4	14 1/4	13 1/2	14 7/8	13 3/8	14 1/8	13 3/16	14 1/4	13	14	....	....	....	....
October	13.75	14.90	13 9/16	14 5/8	13 7/8	14 7/8	14	14 3/4	13 9/16	14 11/16	13 5/16	14 5/8	....	....	....	....
November	14.55	15.15	14 3/16	14 3/4	14 3/8	15 1/8	14 3/8	15	13 15/16	14 5/8	14	14 5/8	....	....	....	....
December	14.80	15.25	14 11/16	14 15/16	15 1/8	15 3/8	14 7/8	15	14 3/8	14 11/16	14 3/8	14 3/4	....	....	....	....
Year	13.60	19.75	13 1/4	15 3/4	13 1/2	15 5/8	13 3/8	15 7/8	13 3/16	15 5/8	13	15 5/8	....	....	....	....

COTTON CROP IN THE UNITED STATES, 1790–1910.

Intelligent use of the following table depends upon observing these explanations:

YEAR.—The year mentioned is, for production, that of planting and growth; but ginning continues into the following calendar year. When, in want of figures for production, a commercial crop is taken, this represents the trade movement beginning Sept. 1 of the growth year and ending Aug. 31 of the following year. The year for exports and imports begins Oct. 1 of the growth year for the period 1790–1842 (1842 is a nine-month year); July 1 for 1843–66 (1866 is a fourteen-month year); and Sept. 1 for 1867 and subsequently; except that the average price of exports per pound given for the years 1791–1800 (average for following and nearly coincident calendar years adopted) is derived from a report of Secretary of Treasury Woodbury (Ex. Doc. No. 146, 24th Cong., 1st sess.).

PRODUCTION—NUMBER OF RUNNING BALES.—1790–1834 and 1839, production, total net weight in pounds divided by net weight per bale; 1835–38, 1840–48, 1850–58, 1860, 1865–68, 1870–78, 1880–83, commercial crop, Latham, Alexander & Company's Cotton Movement and Fluctuation; 1884–88, 1890–98, U. S. Department of Agriculture; 1849, 1859, 1869, 1879, 1889, 1899 and subsequently, production, Census; 1861–64, commercial crop, Production and Price of Cotton for One Hundred Years, by James L. Watkins, Bulletin No. 9, Bureau of Statistics, U. S. Department of Agriculture. Linters included, 1899 and subsequently. Number of running bales of linters, 1899, 114,544; 1900, 143,500; 1901, 166,026; 1902, 196,223; 1903, 195,752; 1904, 245,973; 1905, 230,497; 1906, 322,064; 1907, 268,060; 1908, 346,126; 1909, 313,478.

PRODUCTION—500-POUND BALES.—Linters included, 1899 and subsequently, with same number of bales as above for 1899–1902; 500-pound bales in 1903, 194,486; 1904, 241,942; 1905, 229,539; 1906, 321,689; 1907, 268,282; 1908, 345,507; 1909, 310,433.

PRODUCTION—NET WEIGHT PER BALE.—1790–1898, Bulletin No. 9, above, and Latham, Alexander & Company, above, except that for the census crops of 1849, 1859, and 1869 the equivalent 400-pound bale, net lint, computed for the census, is adopted; 1899 and subsequently, Census. Linters not included.

PRODUCTION—TOTAL NET WEIGHT.—1790–1834, production, report of Secretary Woodbury, above; 1839, production, Census; 1835–38, 1840–48, 1850–58, 1860–68, 1870–78, 1880–88, 1890–98; commercial crop; 1849, 1859, 1869, 1879, 1889, 1899 and subsequently, production, number of bales multiplied by average net weight per bale. Linters not included.

PRODUCTION—PER ACRE.—1868–78, 1880–88, 1890–98, 1900 and subsequently, Bureau of Statistics, U. S. Department of Agriculture; 1879, 1889, 1899, Census.

PRICE PER POUND OF LINT.—1869–98, and 1907 and subsequently, farm price, Dec. 1, Bureau of Statistics, Department of Agriculture, specific inquiry; 1899, Census, total farm value divided by total net weight; 1900–1, no information; 1902–6, Census, New Orleans Cotton Exchange value for upland cotton, computed by multiplying total net weight by mean exchange price for estimated average grade, and Charleston and Savannah Cotton Exchange value for sea-island cotton. Linters not included.

TOTAL VALUE OF LINT.—Total net weight multiplied by price per pound, except for 1899, Census. Linters not included, because included in value of seed, which was in total as follows for the only years for which ascertainable: At the farm, 1899, $46,950,575; at the mill, 1902, $80,209,194; 1903, $84,050,000; 1904, $90,930,000; 1905, $75,470,000; 1906, $81,340,000; 1907, $87,330,000; 1908, $92,420,000; 1909, $123,740,000.

DOMESTIC EXPORTS.—Including reexports, 1790–1800, not including reexports 1801–19, American State Papers; 1820–1906, Bureau of Statistics, Department of Commerce and Labor. Civil war, 1860–64, and deficient record of exports. Linters included, 1897 and subsequently; uncertain whether included before 1897 and after this class of cotton first appeared in trade, soon after 1870.

IMPORTS, LESS REEXPORTS.—Imports, including reexports, 1790–1800, not including reexports, 1801–18, American State Papers; 1819, Report of Secretary Woodbury, above; 1820 and subsequently, Bureau of Statistics, Department of Commerce and Labor; except that the imports given for the years 1791–93 are for the following calendar years, being nearly coincident with the commercial crop years, and the report of imports for 1857–60 is wanting or only fragmentary as to quantity.

LINTERS.—1899 and subsequently, included in production of running bales and equivalent 500-pound bales, and in consumption. Included in domestic exports, as explained above.

CONSUMPTION.—Linters included, 1899 and subsequently. No account taken of stocks at beginning and end of year. The figures are from the formula of production plus net imports minus domestic exports, and do not stand for actual consumption for any certain year, concerning which see annual bulletins of Bureau of the Census concerning supply and distribution of cotton.

CONSUMPTION OF UNMANUFACTURED FIBER—PER CAPITA.—Weighted averages: 1790–95, 1.12 pounds; 1796–1800, 2.05 pounds; 1801–5, 4.58 pounds; 1806–10, 3.98 pounds; 1811–15, 4.56 pounds; 1816–20, 4.55 pounds; 1821–25, 4.54 pounds; 1826–30, 6.13 pounds; 1831–35, 6.05 pounds; 1836–40, 7.08 pounds; 1841–45, 10.98 pounds; 1846–50, 11.78 pounds; 1851–55, 13.17 pounds; 1856–60, 21.65 pounds; 1861–65, 22.38 pounds; 1866–70, 10.15 pounds; 1871–75, 12.88 pounds; 1876–80, 15.43 pounds; 1881–85, 1736 pounds; 1886–90, 19.00 pounds; 1891–95, 19.10 pounds; 1896–1900, 22.45 pounds; 1901–5, 23.03 pounds.

AREA.—Of production and population: Contiguous United States; of trade: Contiguous United States, Alaska, Hawaii, and Porto Rico; of total and per capita consumption: Contiguous United States, no allowance being made for the production and trade of Alaska, Hawaii, and Porto Rico because too small, if anything, to affect the result.

FIVE-YEAR AVERAGES.—The percentages of production retained for consumption and the per capita consumption of unmanufactured fiber are weighted averages; net weight per bale, yield per acre, and price per pound are means.

GOLD VALUES.—All values have been reduced to gold for 1862–78.

BUREAU OF THE CENSUS.—In the preparation of the following table the Bureau of Statistics of the Department of Agriculture has been favored with the cooperation of the Bureau of the Census of the Department of Commerce and Labor.

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COTTON—Continued.

Production, value, domestic exports, net imports, and consumption of cotton in the United States, 1790–1909.

Year.	Production.					Value of lint at farm or exchange.		Domestic exports, beginning in year mentioned.				Imports, less reexports, beginning in year mentioned.			Retained and received for consumption, in 500-pound bales, gross weight.	
	Running bales, counting round as half bales.	Equivalent 500-pound bales, gross weight.	Net weight of lint per bale.	Total net weight of lint.	Average yield per acre.	Price per pound.	Total value.	Gross weight.	Equivalent 500-pound bales, gross weight.	Export value.	Export price per pound, gross weight.	Net weight.	Equivalent 500-pound bales, gross weight.	Value.	Quantity.	Per cent of production.
	Number.	*Number.*	*Pounds.*	*Pounds.*	*Pounds.*	*Cents.*	*Dollars.*	*Pounds.*	*Number.*	*Dollars.*	*Cents.*	*Pounds.*	*No.*	*Dollars.*	*Number.*	*Per ct.*
1790	6,667	3,138	225	1,500,000	....	....	....	189,316	379	47,329	25.0	333,124	697	82,884	3,456	110.1
1791	8,889	4,184	225	2,000,000	....	....	....	138,328	277	....	29.0	531,743	1,112	....	5,019	120.0
1792	13,333	6,276	225	3,000,000	....	....	....	548,550	1,097	....	32.0	2,630,239	5,503	....	10,682	170.2
1793	22,222	10,460	225	5,000,000	....	....	....	1,782,310	3,565	....	33.0	2,450,673	5,127	....	12,022	114.9
1794	35,556	16,736	225	8,000,000	....	....	....	4,707,225	9,414	....	36.5	4,106,973	8,592	....	15.914	95.1
1795	35,556	16,736	225	8,000,000	....	....	....	6,106,729	12,213	....	36.5	4,176,347	8,737	....	13,260	79.2
1796	44,444	20,921	225	10,000,000	....	....	....	3,788,429	7,577	....	34.0	3,506,577	7,336	....	20,680	98.8
1797	48,889	23,013	225	11,000,000	....	....	....	9,360,005	18,720	....	39.0	3,709,863	7,761	....	12,054	52.4
1798	66,667	31,381	225	15,000,000	....	....	....	9,532,263	19,065	....	44.0	3,600,297	7,532	....	19,848	63.2
1799	88,889	41,841	225	20,000,000	....	....	....	17,789,803	35,580	....	28.0	4,239,987	8,870	....	15,131	36.2
1800	153,509	73,222	228	35,000,000	....	....	....	20,911,201	41,822	....	44.0	4,156,926	8,696	....	40,960	54.8
1801	210,526	100,418	228	48,000,000	....	....	....	23,884,023	47,768	5,250,000	19.1	*a* 81,203	*a* 170	*a* 20,038	52,480	52.3
1802	231,092	115,063	238	55,000,000	....	....	....	37,712,079	75,424	7,920,000	19.3	*a* 551,044	*a* 1,153	*a* 137,375	38,486	33.4
1803	222,222	125,523	270	60,000,000	....	....	....	35,034,175	70,068	7,650,000	20.1	87,287	183	21,788	55,638	44.3
1804	261,044	135,983	249	65,000,000	....	....	....	38,390,087	76,780	9,445,000	24.6	218,137	456	....	59,659	43.9
1805	304,348	146,444	230	70,000,000	....	....	....	35,657,465	71,315	8,332,000	23.4	459,247	961	....	76,090	52.0
1806	285,714	167,364	280	80,000,000	....	....	....	63,944,459	127,889	14,232,000	22.3	709,592	1,485	....	40,960	24.5
1807	289,855	167,364	276	80,000,000	....	....	....	10,630,445	21,261	2,221,000	20.9	3,009,985	6,297	....	152,400	91.1
1808	334,821	156,904	224	75,000,000	....	....	....	50,990,255	101,981	8,515,000	16.7	*a* 765,367	*a* 1,601	....	53,322	34.0
1809	328,000	171,548	250	82,000,000	....	....	....	93,261,462	186,523	15,108,000	16.2	*a* 267,515	*a* 560	....	*b* 15,535	....
1810	286,195	177,824	297	85,000,000	....	....	....	62,058,236	124,116	9,652,000	15.6	206,040	431	....	54,139	30.4
1811	325,203	167,364	246	80,000,000	....	....	....	28,887,377	57,775	3,080,000	10.7	428,906	897	....	110,486	66.0
1812	304,878	156,904	246	75,000,000	....	....	....	19,110,016	38,220	2,324,000	12.2	1,497,399	3,133	....	121,817	77.6
1813	304,878	156,904	246	75,000,000	....	....	....	17,729,007	35,458	2,683,000	15.1	48,366	101	....	121,547	77.5
1814	254,545	146,444	275	70,000,000	....	....	....	82,998,747	165,997	17,529,000	21.1	*a* 127,175	*a* 266	....	*b* 19,821	....
1815	369,004	209,205	271	100,000,000	....	....	....	81,947,116	163,894	24,106,000	29.4	*a* 21,122	*a* 44	....	45,267	21.6

1816	439,716	259,414	282	124,000,000				85,649,328	171,299	22,627,614	26.4	978,781	2,048		90,163	34.8
1817	465,950	271,967	279	130,000,000				92,471,178	184,942	31,334,258	33.2	1,474,987	3,086		90,111	33.1
1818	446,429	261,506	280	125,000,000				87,997,045	175,994	21,081,769	24.0	*a* 2,129,202	*a* 4,454		81,058	31.0
1819	632,576	349,372	264	167,000,000				127,860,152	255,720	22,308,667	17.4	*a* 2,184,772	*a* 4,571		89,081	25.5
1820	575,540	334,728	278	160,000,000				124,893,405	249,787	20,157,484	16.1	204,286	427	36,361	85,368	25.5
1821	636,042	376,569	283	180,000,000				144,675,095	289,350	24,035,058	16.6	*a* 93,677	*a* 196	*a* 26,777	87,023	23.1
1822	704,698	439,331	298	210,000,000				173,723,270	347,447	20,445,520	11.8	52,639	110	16,109	91,994	20.9
1823	656,028	387,029	282	185,000,000				142,369,663	284,739	21,947,401	15.4	415,601	932	71,075	103,222	26.7
1824	751,748	449,791	286	215,000,000				176,449,907	352,900	36,846,649	20.9	12,642	26	*a* 10,222	96,917	21.5
1825	817,308	533,473	312	255,000,000				204,535,415	409,071	25,025,214	12.2	37,995	79	18,914	124,481	23.3
1826	1,057,402	732,218	331	350,000,000				294,310,115	588,620	29,359,545	10.0	35,469	74	4,159	143,672	19.6
1827	805,970	564,854	335	270,000,000				210,590,463	421,181	22,487,229	10.7	285,272	597	34,926	144,270	25.5
1828	953,079	679,916	341	325,000,000				264,837,186	529,674	26,575,311	10.0	*a* 18,996	*a* 40	3,371	150,202	22.1
1829	1,076,696	763,598	339	365,000,000				298,459,102	596,918	29,674,883	9.9	180,530	378	11,511	167,058	21.9
1830	1,026,393	732,218	341	350,000,000				276,979,784	553,960	25,289,492	9.1	10,447	22	6,198	178,280	24.3
1831	1,069,444	805,439	360	385,000,000				322,215,122	644,430	31,724,682	9.8	*a* 10,289	*a* 22	15,988	160,987	20.0
1832	1,114,286	815,900	350	390,000,000				324,698,604	649,397	36,191,105	11.1	33,131	69	*a* 1,600	166,572	20.4
1833	1,225,895	930,962	363	445,000,000				384,717,907	769,436	49,448,402	12.9	147,265	308	2,161	161,834	17.4
1834	1,253,406	962,343	367	460,000,000				387,358,992	774,718	64,961,302	16.8	752,439	1,574	66,456	189,199	19.7
1835	1,360,725	1,061,821	373	507,550,425				423,631,307	847,263	71,284,925	16.8	204,277	427	30,864	214,985	20.2
1836	1,423,930	1,129,016	379	539,669,470				444,211,537	888,423	63,240,102	14.2	*a* 243,729	*a* 510	*a* 24,721	240,083	21.3
1837	1,801,497	1,428,384	379	682,767,363				595,952,297	1,191,905	61,556,811	10.3	169,558	355	30,755	236,834	16.6
1838	1,360,532	1,092,980	384	522,444,288				413,624,212	827,248	61,238,982	14.8	152,638	319	*a* 28,928	266,051	24.3
1839	2,063,915	1,653,722	383	790,479,445				743,941,061	1,487,882	63,870,307	8.6	141,808	297	23,528	166,137	10.0
1840	1,634,954	1,347,640	394	644,171,876				530,204,100	1,060,408	54,330,341	10.2	578,290	1,210	36,102	288,442	21.4
1841	1,683,574	1,398,282	397	668,378,878				584,717,017	1,169,434	47,593,464	8.1	51,216	107	*a* 15,005	228,955	16.4
1842	2,378,875	2,035,481	409	972,959,875				792,297,106	1,584,594	49,119,806	6.2	877,191	1,835	32,602	452,722	22.2
1843	2,030,409	1,750,060	412	836,528,508				663,633,455	1,327,267	54,063,501	8.1	247,272	517	*a* 119,959	423,310	24.2
1844	2,394,503	2,078,910	415	993,718,745				872,905,996	1,745,812	51,739,643	5.9	*a* 325,038	*a* 680	*a* 145,569	332,418	16.0
1845	2,100,537	1,806,110	411	863,320,707				547,558,055	1,095,116	42,767,341	7.8	184,674	386	*a* 23,674	711,380	39.4
1846	1,778,651	1,603,763	431	766,598,581				527,219,958	1,054,440	53,415,848	10.1	58,380	122	4,099	549,445	34.3
1847	2,439,786	2,128,433	417	1,017,390,762				814,274,431	1,628,549	61,998,294	7.6	266,741	558	2,087	500,442	23.5
1848	2,866,938	2,615,031	436	1,249,984,968				1,026,602,269	2,053,204	66,396,967	6.5	10,378	22	104	561,849	21.5
1849	2,469,093	2,066,187	400	987,637,200				635,381,604	1,270,763	71,984,616	11.3	231,978	485	6,897	795,909	38.5
1850	2,454,442	2,136,083	416	1,021,047,872				927,237,089	1,854,474	112,315,317	12.1	157,757	330	11,281	281,939	13.2
1851	3,126,310	2,799,290	428	1,338,060,680				1,093,230,639	2,186,461	87,965,732	8.0	244,548	512	12,521	613,341	21.9
1852	3,416,214	3,130,338	438	1,496,301,732				1,111,570,370	2,223,141	109,456,404	9.8	680,106	1,423	38,053	908,620	29.0
1853	3,074,979	2,766,194	430	1,322,240,970				987,833,106	1,975,666	93,596,220	9.5	545,210	1,141	31,318	791,669	28.6
1854	2,982,634	2,708,082	434	1,294,463,156				1,008,424,601	2,016,849	88,143,844	8.7	2,115,367	4,425	131,457	695,658	25.7
1855	3,665,557	3,220,782	420	1,539,533,940				1,351,431,701	2,702,863	128,382,351	9.5	1,096,841	2,295	71,335	520,214	16.2

a Excess of foreign exports over total imports.

b Excess of domestic exports over production and less reexports.

COTTON—Continued.

Production, value, domestic exports, net imports, and consumption of cotton in the United States, 1790-1909—Continued.

Year.	Production.					Value of lint at farm or exchange.		Domestic exports, beginning in year mentioned.				Imports, less reexports, beginning in year mentioned.			Retained and received for consumption, in 500-pound bales, gross weight.	
	Running bales, counting round as half bales.	Equivalent 500-pound bales, gross weight.	Net weight of lint per bale.	Total net weight of lint.	Average yield per acre.	Price per pound.	Total value.	Gross weight	Equivalent 500-pound bales, gross weight.	Export value.	Export price per pound, gross weight.	Net weight.	Equivalent 500-pound bales, gross weight.	Value.	Quantity.	Per cent of production.
	Number.	*Number.*	*Pounds.*	*Pounds.*	*Pounds.*	*Cents.*	*Dollars.*	*Pounds.*	*Number.*	*Dollars.*	*Cents.*	*Pounds.*	*No.*	*Dollars.*	*Number.*	*Per ct.*
1856	3,093,737	2,873,680	444	1,373,619,228				1,048,282,475	2,096,565	131,575,859	12.6	802,233	1,678	62,172	778,793	27.1
1857	3,257,339	3,012,016	442	1,439,743,838				1,118,624,012	2,237,248	131,386,661	11.7			41,356	774,768	25.7
1858	4,018,914	3,758,273	447	1,796,454,558				1,386,468,562	2,772,937	161,434,923	11.6			33,137	985,336	26.2
1859	5,387,052	4,507,993	400	2,154,820,800				1,767,686,338	3,535,373	191,806,555	10.9			130,288	972,620	21.6
1860	3,849,469	3,841,416	477	1,836,196,713				307,516,099	615,032	34,051,483	11.1			58,448	3,226,384	84.0
1861	4,500,000	4,490,586	477	2,146,500,000				5,064,564	10,129	1,162,411	22.9	29,507,187	61,731	6,501,482	4,542,188	101.1
1862	1,600,000	1,596,653	477	763,200,000				11,384,986	22,770	4,849,603	42.6	32,358,232	67,695	9,747,599	1,641,578	102.8
1863	450,000	449,059	477	214,650,000				11,993,911	23,988	6,333,347	52.8	25,049,722	52,405	7,782,961	477,476	106.3
1864	300,000	299,372	477	143,100,000				8,894,374	17,789	3,384,018	38.1	32,885,584	68,798	12,932,280	350,381	117.0
1865	2,269,316	2,093,658	441	1,000,768,356				650,572,829	1,301,146	200,346,279	30.8	4,933,681	10,322	859,322	802,834	38.3
1866	2,097,254	1,948,077	444	931,180,776				700,848,516	1,401,697	149,818,351	21.4	*a* 494,835	*a* 1,035	216,041	545,345	28.0
1867	2,519,554	2,345,610	445	1,121,201,530	189.8			751,378,343	1,502,756	103,371,304	13.7	164,899	345	53,783	843,199	35.9
1868	2,366,467	2,198,141	444	1,050,711,348	192.2			650,224,486	1,300,449	119,671,438	18.6	894,076	1,870	269,855	899,562	40.9
1869	3,011,996	2,520,499	400	1,204,798,400	196.9	16.5	198,791,736	993,854,009	1,987,708	188,322,906	19.5	1,446,413	3,026	252,178	535,817	21.3
1870	4,352,317	4,024,527	442	1,923,724,114	198.9	12.1	232,770,618	1,461,378,310	2,922,757	192,212,480	13.3	861,042	1,802	150,292	1,103,572	27.4
1871	2,974,351	2,756,564	443	1,317,637,493	148.2	17.9	235,857,111	912,468,397	1,824,937	159,924,901	17.5	3,046,805	6,374	584,058	938,001	34.0
1872	3,930,508	3,650,932	444	1,745,145,552	188.7	16.5	287,949,016	1,235,294,963	2,470,590	203,073,651	16.4	4,787,635	10,016	855,638	1,190,358	32.6
1873	4,170,388	3,873,750	444	1,851,652,272	179.7	14.1	261,082,970	1,341,315,340	2,682,631	185,179,520	14.6	1,692,601	3,541	325,259	1,194,660	30.8
1874	3,832,991	3,528,276	440	1,686,516,040	147.5	13.0	219,247,085	1,252,058,889	2,504,118	167,726,380	13.3	1,808,594	3,784	351,302	1,027,942	29.1
1875	4,632,313	4,302,818	444	2,056,746,972	190.6	11.1	228,298,914	1,518,825,111	3,037,650	171,396,873	11.3	2,150,171	4,498	331,474	1,269,666	29.5
1876	4,474,069	4,118,390	440	1,968,590,360	167.8	9.9	194,890,446	1,419,709,173	2,839,418	155,521,838	11.1	2,309,632	4,832	354,406	1,283,804	31.2
1877	4,773,865	4,494,224	450	2,148,239,250	162.1	10.5	225,565,121	1,598,719,266	3,197,439	174,657,633	11.0	2,411,973	5,046	398,761	1,301,831	29.0
1878	5,074,155	4,745,078	447	2,268,147,285	191.4	8.2	185,988,077	1,645,083,172	3,290,167	163,805,068	10.0	2,413,644	5,049	420,410	1,459,960	30.8
1879	5,755,359	5,466,387	454	2,612,932,986	180.5	10.2	266,519,165	1,871,376,133	3,742,752	217,365,305	11.6	3,622,164	7,578	589,018	1,731,213	31.7
1880	6,605,750	6,356,998	460	3,038,645,000	184.5	9.8	297,787,210	2,227,747,731	4,453,495	251,402,569	11.3	2,603,930	5,447	470,620	1,908,950	30.0

1881......	5,456,048	5,136,447	450	2,455,221,600	149.8	10.0	245,522,160	1,688,260,547	3,376,521	194,649,437	11.5	1,558,855	3,261	431,062	1,763,187	34.3
1882......	6,949,756	6,833,442	470	3,266,385,320	185.7	9.9	323,372,147	2,295,665,741	4,591,331	246,883,483	10.8	2,254,261	4,716	506,499	2,246,827	32.9
1883......	5,713,200	5,521,963	462	2,639,498,400	164.8	9.0	237,554,856	1,866,684,497	3,733,369	197,984,295	10.6	5,376,152	11,247	1,109,056	1,799,841	32.6
1884......	5,682,000	5,468,033	460	2,613,720,000	153.8	9.2	240,462,240	1,865,084,912	3,730,170	198,744,802	10.7	3,415,049	7,144	623,977	1,745,007	32.0
1885......	6,575,691	6,369,341	463	3,044,544,933	163.9	8.5	258,786,319	2,100,323,244	4,200,647	208,429,904	9.9	3,952,936	8,270	536,146	2,176,964	34.2
1886......	6,505,087	6,314,561	464	3,018,360,368	169.5	8.1	247,140,771	2,150,770,791	4,301,542	204,740,804	9.5	3,609,874	7,552	484,648	2,020,571	32.0
1887......	7,046,833	6,884,667	467	3,290,871,011	182.8	8.5	279,724,037	2,259,626,754	4,519,254	222,805,494	9.9	5,727,746	11,983	800,038	2,377,396	34.5
1888......	6,938,290	6,923,775	477	3,309,564,330	180.4	8.5	281,312,968	2,365,095,768	4,730,192	235,898,233	10.0	7,305,653	15,284	1,117,961	2,208,867	31.9
1889......	7,472,511	7,472,511	478	3,571,860,258	177.0	8.3	296,464,401	2,464,460,578	4,928,921	250,571,336	10.2	8,763,738	18,334	1,402,251	2,561,924	34.3
1890......	8,652,597	8,562,089	473	4,092,678,381	187.0	8.6	351,970,341	2,925,109,652	5,850,219	291,499,029	10.0	21,787,371	45,580	2,890,394	2,757,450	32.2
1891......	9,035,379	8,940,867	473	4,273,734,267	179.4	7.3	311,982,601	2,948,400,103	5,896,800	258,628,371	8.8	30,780,183	64,394	3,405,229	3,108,461	34.8
1892......	6,700,365	6,658,313	475	3,182,673,375	205.0	8.4	267,344,564	2,242,625,388	4,485,251	190,787,234	8.5	40,981,491	85,735	4,396,692	2,258,797	33.9
1893......	7,493,000	7,430,297	474	3,551,682,000	148.8	7.0	248,617,740	2,653,647,372	5,307,295	208,168,419	7.8	28,394,817	59,405	3,023,113	2,182,407	29.5
1894......	9,901,251	10,025,534	484	4,792,205,484	191.7	4.6	220,441,452	3,480,686,212	6,961,372	200,747,308	5.8	47,513,540	99,399	4,614,472	3,163,561	31.6
1895......	7,161,094	7,146,113	477	3,415,841,838	155.6	7.6	259,603,980	2,380,752,407	4,761,505	194,996,401	8.2	53,536,593	112,001	6,388,991	2,496,609	34.9
1896......	8,532,705	8,514,855	477	4,070,100,285	124.1	6.6	268,626,619	3,063,092,199	6,126,185	227,935,158	7.4	54,832,291	114,712	6,165,576	2,503,382	29.4
1897......	10,897,857	10,989,052	482	5,252,767,074	181.9	6.6	346,682,627	3,919,733,592	7,839,467	233,378,492	6.0	50,573,333	105,802	4,736,169	3,255,387	29.6
1898......	11,274,840	11,534,303	489	5,513,396,760	219.0	5.7	314,263,615	3,827,640,592	7,655,281	212,630,343	5.6	49,340,705	103,223	5,002,387	3,982,245	34.5
1899......	9,507,786	9,459,935	476	4,467,096,999	184.0	7.24	323,758,171	3,110,770,454	6,221,541	246,934,387	7.9	64,423,955	134,778	7,709,490	3,373,172	35.7
1900......	10,245,602	10,266,527	480	4,846,471,000	194.4	......	....	3,430,458,408	6,860,917	319,587,792	9.3	55,739,473	116,610	7,831,882	3,522,220	34.3
1901......	9,748,546	9,675,771	b 474	4,685,852,280	169.0	......	....	3,464,348,519	6,928,697	286,475,568	8.3	90,858,111	190,080	10,840,849	2,937,154	30.4
1902......	10,784,473	10,827,168	480	5,091,640,748	188.5	8.28	421,687,941	3,480,440,015	6,960,880	311,682,217	9.0	71,275,955	149,113	10,569,459	4,015,401	37.1
1903......	10,015,721	10,045,615	480	4,716,591,371	174.5	12.22	576,499,824	3,145,122,483	6,290,245	376,724,537	12.0	47,942,319	100,298	8,384,804	3,855,668	38.4
1904......	13,697,310	13,679,954	478	6,426,697,828	204.9	8.73	561,100,386	4,559,806,854	9,119,614	404,396,821	8.9	62,227,128	130,182	9,576,593	4,690,522	34.3
1905......	10,725,602	10,804,556	482	5,060,205,128	186.1	11.00	556,833,818	3,487,746,773	6,975,494	385,159,047	11.0	63,795,797	133,464	9,901,114	3,962,526	36.7
1906......	13,305,265	13,595,498	489	6,354,107,861	202.5	10.08	640,311,538	4,412,618,231	8,825,236	472,088,260	10.7	101,366,364	212,061	20,039,236	4,982,323	36.6
1907......	11,325,882	11,375,461	480	5,312,948,816	178.3	10.4	552,546,677	3,889,754,147	7,779,508	443,407,637	11.4	70,434,763	147,353	13,757,427	3,743,306	32.9
1908......	13,432,131	13,587,306	484	6,336,072,211	194.9	8.7	551,238,282	4,444,862,162	8,889,724	419,733,103	9.4	82,725,338	173,066	13,111,846	4,870,648	35.8
1909......	10,386,209	10,315,382	475	4,783,220,000	156.8	13.9	664,868,000	3,245,921,303	6,790,630	460,710,176	14.2	75,798,615	158,575	14,076,180	3,683,327	35.7
1910......	b11,941,563	b11,969,757	b 479	b5,722,000,000	b 169.9	14.2	b813,000,000	....	....	....	......	....	....	....	....	......
Average:																
1790-1795	20,370	9,588	225	4,583,333	......	......	....	2,245,410	4,491	....	32.0	2,371,516	4,961	....	10,059	104.9
1796-1800	80,480	38,076	226	18,200,000	......	......	....	12,276,340	24,553	....	37.8	3,842,730	8,039	....	21,562	56.6
1801-1805	245,846	124,686	243	59,600,000	......	......	....	34,135,566	68,271	7,719,400	21.3	26,485	55	....	56,470	45.3
1806-1810	304,917	168,201	265	80,400,000	......	......	....	56,176,971	112,354	9,945,600	18.3	578,547	1,210	....	57,057	33.9
1811-1815	311,702	167,364	257	80,000,000	......	......	....	46,134,453	92,269	9,944,400	17.7	365,275	764	....	75,859	45.3
1816-1820	512,042	295,397	277	141,200,000	......	......	....	103,774,222	207,548	23,501,958	23.4	c331,184	c693	....	87,156	29.5
1821-1825	713,165	437,239	292	209,000,000	......	......	....	168,350,670	336,701	25,659,968	15.4	91,060	190	13,820	100,728	23.0
1826-1830	983,908	694,561	337	332,000,000	......	......	....	269,035,330	538,071	26,677,292	9.9	98,544	206	12,033	156,606	22.6
1831-1835	1,204,751	915,293	363	437,510,085	......	......	....	368,524,386	737,049	50,722,083	13.5	225,365	471	22,774	178,715	19.5
1836-1840	1,656,966	1,330,348	384	635,906,488	......	......	....	545,586,641	1,091,173	60,847,309	11.6	159,713	334	7,347	239,509	18.0

a Excess of foreign exports over total imports. *b* Preliminary. *c* Excess of domestic exports over production and imports less reexports.

COTTON—Continued.

Production, value, domestic exports, net imports, and consumption of cotton in the United States, 1790–1909—Continued.

Year.	Production.					Value of lint at farm or exchange.		Domestic exports, beginning in year mentioned.				Imports, less reexports, beginning in year mentioned.			Retained and received for consumption, in 500-pound bales, gross weight.	
	Running bales, counting round as half bales.	Equivalent 500-pound bales, gross weight.	Net weight of lint per bale.	Total net weight of lint.	Average yield per acre.	Price per pound.	Total value.	Gross weight.	Equivalent 500-pound bales, gross weight.	Export value.	Export price per pound, gross weight.	Net weight.	Equivalent 500-pound bales, gross weight.	Value.	Quantity.	Per cent of production.
	Number.	*Number.*	*Pounds.*	*Pounds.*	*Pounds.*	*Cents.*	*Dollars.*	*Pounds.*	*Number.*	*Dollars.*	*Cents.*	*Pounds.*	*No.*	*Dollars.*	*Number.*	*Per ct.*
1841–1845	2,117,580	1,813,769	409	866,981,343	....	....	....	692,222,326	1,384,445	49,056,751	7.2	207,063	433	a 54,321	429,757	23.7
1846–1850	2,401,782	2,109,899	420	1,008,531,877	....	....	....	786,143,070	1,572,286	73,222,208	9.5	145,047	303	4,894	537,916	25.5
1851–1855	3,253,139	2,924,937	430	1,398,120,096	....	....	....	1,110,498,083	2,220,996	101,508,910	9.1	936,414	1,959	56,937	705,900	24.1
1856–1860	3,921,302	3,598,676	442	1,720,167,027	....	....	....	1,125,715,497	2,251,431	130,051,096	11.6	....	....	65,080	1,347,580	37.4
1861–1865	1,823,863	1,785,866	470	853,643,671	....	....	....	137,582,133	275,164	43,215,132	37.4	24,946,881	52,190	7,564,729	1,562,892	87.5
1866–1870	2,869,518	2,607,371	435	1,246,323,234	....	....	....	911,536,733	1,823,073	150,679,296	17.3	574,319	1,202	188,430	785,500	30.1
1871–1875	3,908,110	3,622,468	443	1,731,539,666	170.9	14.5	246,487,019	1,251,992,540	2,503,985	177,460,265	14.6	2,697,161	5,643	489,546	1,124,126	31.0
1876–1880	5,336,640	5,036,215	450	2,407,310,976	178.8	9.7	234,150,004	1,752,527,095	3,504,654	192,550,483	11.0	2,672,269	5,590	446,643	1,537,245	30.5
1881–1885	6,075,339	5,865,845	461	2,803,874,052	163.6	9.3	261,139,544	1,963,203,788	3,926,408	209,338,384	10.7	3,311,451	6,928	641,348	1,946,365	32.0
1886–1890	7,323,064	7,231,521	472	3,456,666,870	175.7	8.4	291,322,504	2,433,012,709	4,866,026	241,102,979	9.9	9,438,876	19,747	1,339,058	2,385,242	33.0
1891–1895	8,058,218	8,040,225	477	3,843,227,393	176.1	7.0	261,598,067	2,741,222,296	5,482,445	210,665,547	7.8	40,241,325	84,187	4,365,699	2,641,967	32.9
1896–1900	10,091,758	10,152,934	481	4,829,966,424	180.7	....	....	3,470,339,049	6,940,678	248,093,234	7.2	54,981,951	115,025	6,289,101	3,327,281	32.8
1901–1905	10,994,330	11,006,613	479	5,196,197,471	184.6	....	....	3,627,492,929	7,254,986	352,887,638	9.8	67,219,862	140,627	9,854,564	3,892,254	35.4
1906–1910	b 12,078,210	b 12,168,681	b 481	b 5,701,669,778	b 180.5	11.5	b 644,392,899	....	....	....	....	....	....	....	....	....

a Excess of domestic exports over production and imports less reexports.

b Preliminary.

COTTON—Continued.

International trade in cotton, 1905–1909.[a]

[Bales of 500 pounds, gross weight, or 478 pounds of lint, net.]

EXPORTS.

Country.	Year beginning—	1905.	1906.	1907.	1908.	1909.
		Bales.	*Bales.*	*Bales.*	*Bales.*	*Bales.*
Brazil	Jan. 1	111,069	146,060	129,308	16,441	45,974
British India	Jan. 1	1,628,666	1,625,261	2,214,504	1,423,692	1,788,739
China	Jan. 1	229,160	214,656	275,608	171,132	176,761
Egypt	Jan. 1	1,352,516	1,387,636	1,421,818	1,315,968	1,441,631
France	Jan. 1	164,814	169,840	193,357	213,791	270,387
Germany [b]	Jan. 1	158,722	181,056	269,548	248,768	255,294
Netherlands	Jan. 1	98,851	105,827	111,005	108,262	134,994
Persia	Mar. 21	81,931	91,431	89,689	83,985	128,031
Peru	Jan. 1	44,098	48,174	56,910	143,739	[c] 143,739
United States	Jan. 1	8,310,524	7,700,458	8,769,988	9,152,070	8,149,477
Other countries	....	117,167	137,225	160,971	118,000	[d] 148,000
Total	....	12,297,518	11,807,624	13,692,706	12,995,848	12,683,027

IMPORTS.

Country.	Year beginning—	1905.	1906.	1907.	1908.	1909.
Austria-Hungary	Jan. 1	752,110	762,887	928,097	816,444	866,981
Belgium	Jan. 1	220,252	249,285	287,095	226,183	308,583
Canada	Jan. 1	126,711	144,484	131,737	125,546	156,175
France	Jan. 1	1,104,700	1,124,520	1,258,161	1,294,295	1,469,837
Germany [b]	Jan. 1	1,858,054	1,895,837	2,323,684	2,189,209	2,235,384
Italy	Jan. 1	761,328	844,118	1,005,293	953,538	880,187
Japan	Jan. 1	1,184,213	842,749	1,139,993	890,132	1,071,801
Mexico	Jan. 1	61,384	15,670	3,820	7,611	59,071
Netherlands	Jan. 1	210,026	208,638	245,315	243,184	238,003
Russia	Jan. 1	791,248	757,035	821,027	1,100,041	[d] 848,424
Spain	Jan. 1	352,245	401,409	422,331	437,752	325,486
Sweden	Jan. 1	89,154	95,207	95,208	97,755	79,746
Switzerland	Jan. 1	110,556	109,592	118,430	107,309	109,590
United Kingdom	Jan. 1	4,017,610	3,686,006	4,302,404	3,702,357	4,017,004
United States	Jan. 1	142,982	137,415	236,293	154,662	193,940
Other countries	....	292,657	257,894	299,007	309,000	[d] 298,000
Total	....	12,075,230	11,532,746	13,617,895	12,655,018	13,158,212

[a] See "General note," p. 507.
[b] Not including free ports prior to March 1, 1906.
[c] Year preceding.
[d] Preliminary.

International trade in cotton-seed oil, 1905–1909.[a]

EXPORTS.

Country.	Year beginning—	1905.	1906.	1907.	1908.	1909.
		Gallons.	*Gallons.*	*Gallons.*	*Gallons.*	*Gallons.*
Belgium	Jan. 1	1,252,803	1,218,611	1,371,671	1,248,975	1,096,092
Egypt	Jan. 1	249,843	360,883	214,732	231,564	396,982
France	Jan. 1	511,743	602,856	543,110	681,400	775,167
Netherlands	Jan. 1	168,686	108,062	74,686	267,693	44,409
United Kingdom	Jan. 1	5,323,636	7,654,982	8,402,909	8,595,491	6,506,155
United States	Jan. 1	53,368,839	40,297,852	39,115,276	48,930,381	45,514,435
Other countries	....	38,003	4,735	4,089	44,000	[b] 62,000
Total	....	60,913,553	50,247,981	49,726,473	59,999,504	54,395,240

[a] See "General note," p. 507.
[b] Preliminary.

COTTON—Continued.

International trade in cotton-seed oil, 1905–1909—Continued.

IMPORTS.

Country.	Year beginning—	1905.	1906.	1907.	1908.	1909.
		Gallons.	*Gallons.*	*Gallons.*	*Gallons.*	*Gallons.*
Algeria	Jan. 1	1,163,468	1,091,215	1,106,262	961,213	1,372,723
Australia	Jan. 1	178,797	54,094	70,339	133,737	118,632
Austria-Hungary	Jan. 1	5,499,759	5,866,528	9,391	219,463	30,306
Belgium	Jan. 1	3,037,814	2,698,477	2,680,250	2,201,913	2,207,083
Brazil	Jan. 1	759,755	947,023	1,189,127	892,363	[a] 892,363
Canada	Jan. 1	1,064,773	1,175,676	1,684,614	1,558,995	2,103,232
Egypt	Jan. 1	416,962	153,722	51,674	740,987	489,737
France	Jan. 1	11,082,265	9,859,577	8,971,580	12,314,045	6,479,378
Germany [b]	Jan. 1	16,767,840	16,203,800	15,109,019	12,617,710	10,093,188
Italy	Jan. 1	3,429,991	786,563	902,692	3,095,547	9,002,322
Malta	Apr. 1	235,683	224,712	192,520	241,726	322,839
Martinique	Jan. 1	300,232	301,430	289,058	319,643	[a] 319,643
Mexico	Jan. 1	3,960,087	3,881,825	3,809,854	4,372,063	5,489,939
Netherlands	Jan. 1	4,764,653	5,418,951	5,950,945	5,984,030	4,432,512
Senegal	Jan. 1	387,607	352,461	370,617	355,962	[a] 355,962
United Kingdom	Jan. 1	4,048,873	3,224,727	3,922,618	4,584,145	4,893,653
Uruguay	July 1	342,341	304,092	[a] 2,568	[a] 2,568	[c] 2,568
Other countries		792,753	3,092,742	3,670,815	6,279,000	[d] 6,460,000
Total		58,233,653	55,637,615	49,983,943	56,875,110	55,066,080

[a] Year preceding.
[b] Not including free ports prior to March, 1906.
[c] Data for 1907.
[d] Preliminary.

TOBACCO.

Tobacco crop of countries named, 1905–1909.

Country.	1905.	1906.	1907.	1908.	1909.
NORTH AMERICA.					
United States:	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Contiguous	633,034,000	682,429,000	698,126,000	718,061,000	949,357,000
Noncontiguous—Porto Rico [a]	6,000,000	8,000,000	13,000,000	10,000,000	10,000,000
Total United States (except Philippine Islands)	639,034,000	690,429,000	711,126,000	728,061,000	959,357,000
Canada:					
Ontario	6,500,000	7,575,000	([b])	[a] 3,504,000	[a] 5,610,000
Quebec	3,100,000	3,750,000	[a] 3,000,000	[a] 7,656,000	[c] 7,656,000
Other [d]	107,000	107,000	107,000	107,000	107,000
Total Canada	9,707,000	11,432,000	3,107,000	11,267,000	13,373,000
Cuba [a]	48,783,000	28,629,000	55,603,000	66,650,000	59,323,000
Guatemala	1,983,000	[e] 1,300,000	[e] 1,300,000	[e] 1,300,000	[e] 1,300,000
Mexico	40,574,000	34,711,000	[f] 34,711,000	[f] 34,711,000	[f] 34,711,000
Santo Domingo	[a] 22,900,000	[a] 30,600,000	26,400,000	[a] 32,500,000	[c] 32,500,000
Total	162,981,000	797,101,000	832,247,000	874,489,000	100,564,000
SOUTH AMERICA.					
Argentina	[g] 43,000,000	[e] 31,000,000	[e] 31,000,000	[g] 31,200,000	[e] 31,000,000
Bolivia [e]	3,000,000	3,000,000	3,000,000	3,000,000	3,000,000
Brazil [h]	44,953,000	52,095,000	65,460,000	32,130,000	65,679,000
Chile	[e] 6,000,000	[e] 6,000,000	[e] 6,000,000	9,067,000	2,984,000
Ecuador	[h] 122,000	[c] 122,000	[h] 144,000	[h] 143,000	[c] 143,000
Paraguay [e]	10,000,000	10,000,000	13,000,000	13,000,000	13,000,000
Peru [e]	1,500,000	1,500,000	1,500,000	1,500 000	1,500,000
Total	108,575,000	103,717,000	120,104,000	90,040,000	117,306,000

[a] Unofficial estimate.
[b] Small crop; no data.
[c] Year preceding.
[d] Estimated from census for 1900.
[e] Average production as unofficially estimated.
[f] Data for 1906.
[g] Estimated from official returns of acreage.
[h] Exports.

TOBACCO—Continued.

Tobacco crop of countries named, 1905–1909—Continued.

Country.	1905.	1906.	1907.	1908.	1909.
EUROPE.					
Austria-Hungary:	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Austria	14,360,000	17,884,000	15,129,000	14,630,000	19,188,000
Hungary	103,076,000	160,616,000	135,013,000	165,638,000	159,000,000
Bosnia-Herzegovina	8,753,000	10,077,000	6,396,000	*a* 6,396,000	11,464,000
Total Austria-Hungary	126,189,000	188,577,000	156,538,000	186,664,000	189,652,000
Belgium	16,646,000	15,001,000	19,476,000	18,597,000	18,597,000
Bulgaria	8,638,000	14,171,000	9,016,000	7,607,000	7,819,000
Denmark	340,000	340,000	160,000	*b* 160,000	*b* 160,000
France	53,863,000	36,416,000	40,810,000	50,056,000	*a* 50,056,000
Germany	70,240,000	70,713,000	61,665,000	75,858,000	62,122,000
Greece	20,000,000	*c* 18,300,000	*c* 14,300,000	*c* 16,500,000	*c* 18,300,000
Italy	15,605,000	14,494,000	14,999,000	*a* 14,999,000	10,479,000
Netherlands	1,490,000	1,609,000	1,700,000	1,700,000	*a* 1,700,000
Roumania	8,694,000	9,994,000	15,554,000	16,099,000	12,098,000
Russia (including Asiatic)	214,050,000	162,020,000	226,258,000	207,948,000	176,953,000
Servia	2,086,000	2,381,000	2,422,000	1,732,000	*a* 1,732,000
Sweden	2,713,000	2,661,000	2,300,000	2,270,000	*a* 2,270,000
Turkey (including Asiatic) *d*	100,000,000	100,000,000	100,000,000	100,000,000	100,000,000
Total	640,554,000	636,677,000	665,198,000	700,190,000	651,938,000
ASIA.					
British India *e*	450,000,000	450,000,000	450,000,000	450,000,000	450,000,000
British North Borneo *e*	3,009,000	3,264,000	2,953,000	3,155,000	2,819,000
Dutch East Indies:					
Java *f*	116,000,000	112,000,000	125,000,000	81,000,000	*g* 67,000,000
Sumatra East Coast of	43,635,000	47,363,000	51,460,000	51,460,000	*g* 49,942,000
Total Dutch East Indies	159,635,000	159,363,000	176,460,000	132,460,000	116,942,000
Japanese Empire:					
Japan	89,931,000	96,997,000	100,390,000	91,374,000	*a* 91,374,000
Formosa	187,000	380,000	471,000	*a* 471,000	*b* 471,000
Total Japanese Empire	90,118,000	97,377,000	100,861,000	91,845,000	91,845,000
Philippine Islands	*h* 38,200,000	*h* 46,800,000	*h* 40,056,000	*h* 38,725,000	40,258,000
Total	740,962,000	756,804,000	770,330,000	716,185,000	701,864,000
AFRICA.					
Algeria	13,006,000	11,668,000	14,177,000	9,306,000	*a* 9,306,000
British Central Africa	326,000	1,037,000	585,000	*a* 585,000	*b* 585,000
Mauritius	13,000	13,000	16,000	26,000	39,000
Nyasaland	326,000	1,037,000	585,000	570,000	1,233,000
Union of South Africa:					
Cape of Good Hope	5,000,000	5,000,000	5,000,000	5,000,000	5,000,000
Natal	2,623,000	3,103,000	2,771,000	3,105,000	2,527,000
Orange River Colony	650,000	*i* 650,000	*i* 650,000	*i* 650,000	646,000
Transvaal	*j* 3,226,000	*j* 3,226,000	5,077,000	2,754,000	2,891,000
Total Union of South Africa	11,499,000	11,979,000	13,498,000	11,509,000	11,064,000
Total	25,170,000	25,734,000	28,861,000	21,996,000	22,227,000
OCEANIA.					
Australia:					
Queensland	798,000	1,146,000	723,000	274,000	604,000
New South Wales	562,000	821,000	602,000	385,000	430,000
Victoria	125,000	157,000	68,000	310,000	296,000
Total Australia	1,485,000	2,124,000	1,393,000	969,000	1,330,000
Fiji	1,000	1,000	44,000	38,000	18,000
Total	1,486,000	2,125,000	1,437,000	1,007,000	1,348,000
Grand total	2,279,728,000	2,322,158,000	2,418,177,000	2,555,100,000	2,595,247,000

a Year preceding.
b Data for 1907.
c Unofficial estimate.
d Average production as unofficially estimated.
e Exports.
f Exports, official returns for production are less than exports.
g Unofficial estimate.
h Estimate from returns of the census.
i Data for 1905.
j Data for 1904.

TOBACCO—Continued.

Acreage, production, value, etc., of tobacco in the United States, 1900–1910.

Year.	Acreage, planted and harvested.	Average yield per acre.	Production.	Average farm price per pound Dec. 1.	Farm value Dec. 1.
	Acres.	*Pounds.*	*Pounds.*	*Cents.*	*Dollars.*
1900	1,046,000	778.0	814,345,000	6.6	53,661,000
1901	1,039,000	788.0	818,953,000	7.1	58,283,000
1902	1,031,000	797.3	821,824,000	7.0	57,564,000
1903	1,038,000	786.3	815,972,000	6.8	55,515,000
1904	806,000	819.0	660,461,000	8.1	53,383,000
1905	776,000	815.6	633,034,000	8.5	53,519,000
1906	796,000	857.2	682,429,000	10.0	68,233,000
1907	821,000	850.5	698,126,000	10.2	71,411,000
1908	875,000	820.2	718,061,000	10.3	74,130,000
1909	1,180,000	804.3	949,357,000	10.1	95,719,000
1910	1,234,000	797.8	984,349,000	9.3	91,459,000

Year.	Domestic exports of unmanufactured, fiscal year beginning July 1.	Imports of unmanufactured, fiscal year beginning July 1.	Condition of growing crop.			
			July 1.	Aug. 1.	Sept. 1.	When harvested.
	Pounds.	*Pounds.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
1900	315,787,782	26,851,253	88.5	82.9	77.5	76.1
1901	301,007,365	29,428,837	86.5	72.1	78.2	81.5
1902	368,184,084	34,016,956	85.6	81.2	81.5	84.1
1903	311,971,831	31,162,636	85.1	82.9	83.4	82.3
1904	334,302,091	33,288,378	85.3	83.9	83.7	85.6
1905	312,227,202	41,125,970	87.4	84.1	85.1	85.8
1906	340,742,864	40,898,807	86.7	87.2	86.2	84.6
1907	330,812,658	35,005,131	81.3	82.8	82.5	84.8
1908	287,900,946	43,123,196	86.6	85.8	84.3	84.1
1909	357,196,074	46,838,330	89.8	83.4	80.2	81.3
1910	....	....	85.3	78.5	77.7	80.2

Acreage, production, and value of tobacco in the United States in 1910.

State, Territory, or Division.	Acreage.	Production.	Farm value December 1.	State, Territory, or Division.	Acreage.	Production.	Farm value December 1.
	Acres.	*Pounds.*	*Dollars.*		*Acres.*	*Pounds.*	*Dollars.*
N. Hampshire	100	172,000	25,800	Illinois	1,600	1,264,000	120,080
Vermont	200	320,000	46,400	Wisconsin	30,200	31,710,000	2,378,250
Massachusetts	4,400	7,612,000	1,141,800	N.C.E.Miss.R.	151,500	131,821,000	11,137,925
Connecticut	13,400	23,182,000	3,825,030				
New York	5,900	7,375,000	626,875	Missouri	7,500	7,875,000	945,000
Pennsylvania	33,000	49,500,000	4,603,500				
N. Atlantic	57,000	88,161,000	10,269,405	N. C. W. Miss. R.	7,500	7,875,000	945,000
Maryland	28,500	19,665,000	1,514,205				
Virginia	160,000	124,800,000	11,232,000	Kentucky	470,400	381,024,000	33,149,088
West Virginia	20,000	12,800,000	1,318,400	Tennessee	85,000	64,600,000	5,426,400
North Carolina	216,000	129,600,000	13,737,600	Alabama	600	300,000	60,000
South Carolina	30,000	18,900,000	1,625,400	Mississippi	100	55,000	11,000
Georgia	1,600	1,088,000	217,600	Louisiana	500	275,000	68,750
Florida	3,500	2,380,000	547,400	Texas	700	420,000	105,000
				Arkansas	900	585,000	93,600
S. Atlantic	459,600	309,233,000	30,192,605	S. Central	558,200	447,259,000	38,913,838
Ohio	92,700	75,087,000	6,382,395				
Indiana	27,000	23,760,000	2,257,200	United States	1,233,800	984,349,000	91,458,773

TOBACCO—Continued.

Average yield per acre of tobacco in the United States.

State.	10-year averages. 1866–1875.	1876–1885.	1886–1895.	1896–1905.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	1909.	1910.
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
New Hampshire	1,151	1,514	......	1,627	1,500	1,650	1,590	1,610	1,700	1,785	1,650	1,800	1,700	1,720
Vermont	1,112	1,490	......	1,735	1,722	1,800	1,800	1,685	1,650	1,700	1,625	1,735	1,675	1,600
Massachusetts	1,379	1,497	1,597	1,695	1,810	1,560	1,400	1,690	1,850	1,750	1,525	1,650	1,600	1,730
Connecticut	1,436	1,354	1,552	1,549	1,580	1,712	1,600	1,685	1,725	1,735	1,510	1,680	1,650	1,730
New York	809	1,295	1,148	[illegible]	1,134	1,250	1,125	1,145	1,118	1,250	1,150	1,175	1,175	1,250
Pennsylvania	1,087	1,222	1,203	1,281	1,495	1,275	[illegible]	1,287	1,370	1,375	1,200	1,325	985	1,500
Maryland	626	705	579	646	597	625	650	621	650	690	660	700	710	690
Virginia	659	637	598	673	635	750	745	725	675	675	760	815	775	780
West Virgina	685	598	650	673	589	635	640	710	790	780	720	750	875	640
North Carolina	577	522	530	592	560	650	627	685	608	580	625	670	600	600
South Carolina	516	248	......	736	768	734	610	703	736	670	900	865	800	630
Georgia	537	248	......	547	494	670	640	650	525	675	860	975	700	680
Florida	603	356	......	589	544	520	700	815	600	875	925	990	710	680
Ohio	844	889	782	833	873	885	845	849	850	1,060	900	670	925	810
Indiana	711	757	666	742	788	835	783	691	819	915	940	700	950	880
Illinois	725	700	585	645	426	650	655	670	900	820	800	755	750	790
Michigan	1,050	504	......	689	655	765	750	675	......	......	......	......	......	......
Wisconsin	893	931	970	1,312	1,354	1,340	1,350	1,282	1,370	1,275	1,100	1,130	1,180	1,050
Missouri	852	815	751	689	459	850	698	626	778	730	825	875	885	1,050
Kentucky	688	737	736	782	867	800	790	827	830	870	890	815	835	810
Tennessee	698	660	641	664	717	650	700	730	768	785	800	800	730	760
Alabama	538	220	468	380	266	400	405	379	450	510	450	450	600	500
Mississippi	532	288	......	530	576	500	502	408	430	440	475	250	500	550
Louisiana	594	......	......	400	323	375	375	438	500	475	350	850	550	550
Texas	671	452	......	500	363	650	650	600	500	550	700	800	650	600
Arkansas	746	604	643	533	344	640	646	565	700	695	570	610	600	650
United States	711.8	736.2	721.5	759.2	788.0	797.3	786.3	819.0	815.6	857.2	850.5	820.2	804.3	797.8

Average farm value per acre of tobacco in the United States December 1.

State.	10-year averages. 1866–1875.	1876–1885.	1886–1895.	1896–1905.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	1909.	1910.
	Dolls.	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*
N. Hampshire	199.00	180.10	......	247.44	225.00	264.00	206.70	241.50	289.00	303.45	198.00	252.00	255.00	258.00
Vermont	197.49	209.26	......	239.78	172.20	252.00	216.00	252.75	280.50	289.00	195.00	225.55	251.25	232.00
Massachusetts	270.85	182.71	249.27	255.88	217.20	234.00	168.00	314.34	312.65	323.75	167.75	255.75	224.00	259.50
Connecticut	297.74	172.11	243.86	272.00	237.90	273.92	248.00	380.81	293.25	312.30	173.65	285.60	272.25	285.45
New York	87.61	151.75	137.01	98.16	79.38	100.00	90.00	114.50	120.54	172.50	69.00	111.62	94.00	106.25
Pennsylvania	127.53	127.83	146.20	100.94	89.70	76.50	103.37	114.72	147.96	188.38	90.00	139.12	88.65	139.50
Maryland	49.23	46.80	36.60	36.29	35.82	37.50	35.75	40.36	39.56	40.80	42.90	52.50	58.93	53.13
Virginia	55.22	44.55	41.78	45.53	50.80	52.50	45.44	53.65	51.30	55.35	79.80	74.98	65.88	70.20
W. Virginia	73.16	50.46	62.92	52.42	47.12	44.45	39.68	60.35	67.15	71.76	72.00	105.00	115.50	65.92
N. Carolina	63.48	51.10	49.96	46.10	50.40	45.50	39.50	58.91	53.50	58.00	68.75	70.35	57.00	63.60
S. Carolina	57.05	33.54	......	55.11	53.76	51.38	31.11	57.65	64.03	70.35	96.30	86.50	58.40	54.18
Georgia	99.79	34.72	......	93.89	88.92	127.30	96.00	133.90	89.25	202.50	344.00	341.25	238.00	136.00
Florida	125.88	65.37	......	167.74	146.88	156.00	224.00	256.72	108.00	306.25	416.25	346.50	241.40	156.40
Ohio	55.92	58.97	54.93	54.79	61.11	61.95	60.84	67.92	71.40	121.90	75.60	70.35	97.12	68.85
Indiana	45.29	46.87	43.83	47.27	39.40	58.45	48.55	58.74	49.14	62.22	92.12	84.00	104.50	83.60
Illinois	53.65	46.97	44.05	37.71	29.82	45.50	39.96	36.18	54.00	57.40	80.00	64.18	82.50	75.05
Michigan	152.20	64.21	......	66.23	45.85	61.20	60.00	43.88	......	......	......	......	......	......
Wisconsin	91.02	99.31	85.59	89.99	108.32	93.80	91.80	100.00	137.00	172.12	71.50	113.00	108.56	78.75
Missouri	67.28	58.19	59.00	68.34	68.85	93.50	62.82	53.21	62.24	65.70	90.75	109.38	115.05	126.00
Kentucky	51.09	51.36	51.52	47.98	52.02	48.00	48.98	52.93	58.10	66.99	90.78	74.16	88.51	70.47
Tennessee	66.19	44.56	49.85	48.26	43.02	39.00	52.50	42.34	57.60	58.88	78.40	72.00	56.94	63.84
Alabama	104.67	36.32	42.11	68.24	50.54	96.00	64.80	58.74	72.00	112.20	108.00	117.00	174.00	100.00
Mississippi	107.09	43.24	......	90.61	103.68	90.00	80.32	63.65	64.50	126.72	142.50	62.50	130.00	110.00
Louisiana	123.24	......	......	92.44	90.44	75.00	75.00	94.17	125.00	130.62	98.00	272.00	203.50	137.50
Texas	134.46	81.75	......	101.00	58.08	143.00	130.00	117.00	95.00	132.00	210.00	200.00	170.30	150.00
Arkansas	100.08	52.23	68.41	66.15	44.72	76.80	77.52	67.80	98.00	83.40	76.95	91.50	90.00	104.00
U.S.	64.24	56.34	57.59	55.95	55.95	55.81	53.47	66.34	69.33	85.72	86.75	84.48	81.23	74.13

TOBACCO—Continued.

Average farm price of tobacco per pound in the United States.

State.	Price Dec. 1, by decades.				Price Dec. 1, by years.									
	1866–1875.	1876–1885.	1886–1895.	1896–1905.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	1909.	1910.
	Cts.	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*
New Hampshire	17.0	11.9	......	15.2	15.0	16.0	13.0	15.0	17.0	17.0	12.0	14.0	15.0	15.0
Vermont	17.3	14.0	......	13.9	10.0	14.0	12.0	15.0	17.0	17.0	12.0	13.0	15.0	14.5
Massachusetts	18.8	12.2	15.6	14.9	12.0	15.0	12.0	18.6	16.9	18.5	11.0	15.5	14.0	15.0
Connecticut	20.6	12.6	15.7	16.5	15.0	16.0	15.5	22.6	17.0	18.0	11.5	17.0	16.5	16.5
New York	10.7	11.5	12.0	8.7	7.0	8.0	8.0	10.0	10.5	13.8	6.0	9.5	8.0	8.5
Pennsylvania	11.2	10.6	12.0	7.6	6.0	6.0	7.3	8.9	10.8	13.7	7.5	10.5	9.0	9.3
Maryland	8.0	6.6	6.3	5.7	6.0	6.0	5.5	6.5	6.0	6.8	6.5	7.5	8.3	7.7
Virginia	8.4	7.1	7.0	6.6	8.0	7.0	6.1	7.4	7.6	8.2	10.5	9.2	8.5	9.0
West Virginia	10.7	8.5	9.8	8.2	8.0	7.0	6.2	8.5	8.5	9.2	10.0	14.0	13.2	10.3
North Carolina	11.0	10.0	9.6	7.7	9.0	7.0	6.3	8.6	8.8	10.0	11.0	10.5	9.5	10.6
South Carolina	11.2	13.5	14.8	7.5	7.0	7.0	5.1	8.2	8.7	10.5	10.7	10.0	7.3	8.6
Georgia	18.4	14.0	16.5	15.8	18.0	19.0	15.0	20.6	17.0	30.0	40.0	35.0	34.0	20.0
Florida	21.0	18.6	31.2	27.5	27.0	30.0	32.0	31.5	18.0	35.0	45.0	35.0	34.0	23.0
Ohio	6.6	6.6	7.0	7.0	7.0	7.0	7.2	8.0	8.4	11.5	8.4	10.5	10.5	8.5
Indiana	6.4	6.3	6.5	6.2	5.0	7.0	6.2	8.5	6.0	6.8	9.8	12.0	11.0	9.5
Illinois	7.2	6.7	7.6	7.0	7.0	7.0	6.1	5.4	6.0	7.0	10.0	8.5	11.0	9.5
Michigan	14.6	12.8	......	7.7	7.0	8.0	8.0	6.5	......	......	......	......	......	......
Wisconsin	10.4	10.6	8.5	7.4	8.0	7.0	6.8	7.8	10.0	13.5	6.5	10.0	9.2	7.5
Missouri	7.9	7.1	7.9	10.3	15.0	11.0	9.0	8.5	8.0	9.0	11.0	12.5	13.0	12.0
Kentucky	7.4	7.0	7.2	6.0	6.0	6.0	6.2	6.4	7.0	7.7	10.2	9.1	10.6	8.7
Tennessee	9.4	6.8	7.8	7.1	6.0	6.0	7.5	5.8	7.5	7.5	9.8	9.0	7.8	8.4
Alabama	19.9	16.5	14.2	18.9	19.0	24.0	16.0	15.5	16.0	22.0	24.0	26.0	29.0	20.0
Mississippi	20.4	15.0	33.0	16.3	18.0	18.0	16.0	15.6	15.0	28.8	30.0	25.0	26.0	20.0
Louisiana	21.8	......	......	22.6	28.0	20.0	20.0	21.5	25.0	27.5	28.0	32.0	37.0	25.0
Texas	20.2	17.2	......	19.4	16.0	22.0	20.0	19.5	19.0	24.0	30.0	25.0	26.2	25.0
Arkansas	13.6	8.5	10.5	12.4	13.0	12.0	12.0	12.0	14.0	12.0	13.5	15.0	15.0	16.0
United States	9.0	7.7	8.0	7.2	7.1	7.0	6.8	8.1	8.5	10.0	10.2	10.3	10.1	9.3

International trade in unmanufactured tobacco, 1905–1909.[a]

EXPORTS.

Country.	Year beginning—	1905.	1906.	1907.	1908.	1909.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Algeria	Jan. 1	6,171,178	9,722,914	7,754,758	4,073,480	[b] 6,222,563
Austria-Hungary	Jan. 1	18,687,919	19,093,790	21,637,704	21,044,440	21,456,931
Brazil	Jan. 1	44,953,473	52,094,709	65,459,601	32,129,345	[b] 65,678,907
British India	Jan. 1	22,824,739	28,092,899	28,787,031	19,006,506	17,195,391
Bulgaria	Jan. 1	5,749,096	3,493,435	2,678,406	5,532,100	4,347,506
Ceylon	Jan. 1	4,617,805	4,390,497	4,425,619	4,075,075	[c] 4,075,075
Cuba	Jan. 1	32,808,058	28,568,069	19,135,347	40,111,922	49,468,425
Dutch East Indies	Jan. 1	108,081,973	160,378,243	156,810,583	175,685,251	[b] 131,668,981
Greece	Jan. 1	13,026,375	17,690,658	14,934,504	10,781,318	13,159,838
Mexico	Jan. 1	4,320,393	4,023,645	4,479,953	3,884,456	2,837,311
Netherlands	Jan. 1	4,003,120	4,345,341	5,163,992	3,751,654	4,232,501
Philippine Islands	Jan. 1	19,832,747	26,685,768	23,589,657	24,927,663	20,976,743
Russia	Jan. 1	15,937,120	18,317,207	14,246,861	17,117,323	[b] 20,403,732
Santo Domingo	Jan. 1	11,675,366	15,179,810	22,947,168	18,665,594	24,822,461
Turkey [d]	Mar. 14	39,267,984	39,267,984	39,267,984	39,267,984	39,267,984
United States	Jan. 1	292,925,181	336,730,455	317,399,986	305,455,871	351,564,177
Other countries		14,230,829	9,872,908	25,094,185	38,790,000	[b] 36,086,000
Total		659,113,356	777,948,332	773,813,339	764,299,982	813,464,526

[a] See "General note," page 507.
[b] Preliminary.
[c] Year preceding.
[d] Data for 1900.

TOBACCO—Continued.

International trade in unmanufactured tobacco, 1905–1909—Continued.

IMPORTS.

Country.	Year beginning—	1905.	1906.	1907.	1908.	1909.
Argentina	Jan. 1	7,081,032	8,353,648	8,689,694	10,500,798	11,756,931
Australia	Jan. 1	5,371,534	7,538,329	10,169,916	12,886,746	9,370,516
Austria-Hungary	Jan. 1	50,850,488	52,855,812	36,349,587	43,908,354	48,820,867
Belgium	Jan. 1	22,141,627	21,146,214	20,158,453	20,927,037	21,194,579
British India	Jan. 1	6,512,590	5,284,295	4,993,124	6,618,473	7,514,446
Canada	Jan. 1	14,738,578	14,821,069	17,338,976	16,760,080	12,744,798
China	Jan. 1	12,116,533	16,034,533	17,770,000	11,234,667	8,273,200
Denmark	Jan. 1	9,744,429	10,399,202	11,208,298	19,896,714	3,306,900
Egypt	Jan. 1	16,501,051	18,250,013	18,801,016	19,147,819	18,753,130
Finland	Jan. 1	8,956,123	9,548,533	9,834,354	9,561,443	9,477,672
France	Jan. 1	66,966,994	54,816,081	62,557,408	63,594,945	44,485,742
Germany [a]	Jan. 1	178,936,160	131,495,120	156,698,138	170,494,442	172,018,104
Italy	Jan. 1	28,127,670	45,918,749	43,913,866	44,893,159	49,666,772
Netherlands	Jan. 1	42,252,451	46,588,181	50,172,040	47,965,176	52,343,677
Norway	Jan. 1	2,956,905	3,487,734	3,877,092	3,648,473	3,700,179
Portugal	Jan. 1	5,388,004	4,355,601	5,713,143	5,160,110	6,990,132
Spain	Jan. 1	48,907,491	30,043,202	51,055,584	31,921,214	40,997,520
Sweden	Jan. 1	7,221,852	8,361,847	9,212,130	9,165,985	9,135,007
Switzerland	Jan. 1	16,048,105	15,747,394	17,561,357	16,721,617	16,542,877
United Kingdom	Jan. 1	82,444,539	83,766,884	87,329,290	87,933,057	85,654,211
United States	Jan. 1	33,887,947	41,726,224	34,088,288	37,665,211	44,221,940
Other countries		56,276,364	55,711,151	50,720,308	61,800,000	[b] 62,602,000
Total		723,428,467	686,249,816	728,212,062	752,405,520	739,571,200

[a] Not including free ports prior to March 1, 1906. [b] Preliminary.

FLAXSEED.

Flax area of countries named, 1907–1909.

Country.	1907.	1908.	1909.
NORTH AMERICA.			
	Acres.	*Acres.*	*Acres.*
United States	2,864,000	2,679,000	2,742,000
Canada:			
Manitoba	25,900	23,400	22,400
Saskatchewan	128,500	110,000	110,300
Alberta	6,500	5,900	5,800
Total	160,900	139,300	138,500
Mexico	(a)	(a)	(a)
SOUTH AMERICA.			
Argentina	2,942,100	3,452,400	3,791,300
Uruguay	73,000	63,500	45,300
Total	3,015,100	3,515,900	3,836,600
EUROPE.			
Austria-Hungary:			
Austria	154,900	123,700	111,100
Hungary proper	30,600	27,100	(a)
Croatia-Slavonia	17,700	17,500	(a)
Bosnia-Herzegovina	(a)	(a)	(a)
Belgium	56,000	51,200	(a)
Bulgaria	400	300	400
France	58,900	70,600	50,500
Italy	(a)	(a)	(a)
Netherlands	41,600	35,600	24,800
Roumania	31,700	44,900	30,100
EUROPE—contd.			
Russia:	*Acres.*	*Acres.*	*Acres.*
Russia proper	3,370,200	3,250,900	3,120,200
Poland	93,800	87,500	90,600
Northern Caucasia	58,700	63,500	63,300
Total Russia (European)	3,522,700	3,401,900	3,274,100
Servia	6,200	(a)	(a)
Sweden	4,700	4,500	(a)
United Kingdom (Ireland)	59,700	46,900	38,100
ASIA.			
British India, including such native States as report	3,743,200	2,099,400	2,997,000
Russia:			
Central Asia	[b] 62,900	[b] 75,300	176,600
Siberia	101,900	111,700	128,800
Transcaucasia	(a)	(a)	22,900
Total Russia (Asiatic)			328,300
AFRICA.			
Algeria	4,300	1,000	(a)

[a] No official data. [b] Four provinces only.

FLAXSEED—Continued.

Flax crop of countries named, 1907–1909.

Country.	Seed.			Fiber.		
	1907.	1908.	1909.	1907.	1908.	1909.
NORTH AMERICA.	*Bushels.*	*Bushels.*	*Bushels.*	*Pounds.*	*Pounds.*	*Pounds.*
United States	25,851,000	25,805,000	25,856,000	....	....	....
Canada:						
Manitoba	317,000	281,000	317,000	....	....	....
Saskatchewan	1,365,000	1,144,000	1,787,000	....	....	....
Alberta	50,000	74,000	109,000	....	....	....
Total	1,732,000	1,499,000	2,213,000	....	....	....
Mexico	150,000	150,000	150,000	....	....	....
Total North America	27,733,000	27,454,000	28,219,000	....	....	....
SOUTH AMERICA.						
Argentina	32,502,000	43,333,000	41,291,000	....	....	....
Uruguay	863,000	723,000	522,000	....	....	....
Total	33,365,000	44,056,000	41,813,000	....	....	....
EUROPE.						
Austria-Hungary:						
Austria	1,239,000	932,000	852,000	102,158,000	74,106,000	68,136,000
Hungary proper	260,000	190,000	200,000	26,018,000	19,965,000	20,000,000
Croatia-Slavonia	7,000	30,000	30,000	10,352,000	8,861,000	9,000,000
Bosnia-Herzegovina	4,000	4,000	4,000	1,400,000	1,400,000	1,400,000
Total Austria-Hungary	1,510,000	1,156,000	1,086,000	139,928,000	104,332,000	98,536,000
Belgium	300,000	300,000	300,000	27,000,000	27,000,000	27,000,000
Bulgaria	2,000	2,000	2,000	64,000	168,000	200,000
France	613,000	722,000	436,000	44,046,000	47,886,000	30,494,000
Italy	(a)	(a)	281,000	7,000,000	7,000,000	7,242,000
Netherlands	392,000	341,000	219,000	26,318,000	19,692,000	13,438,000
Roumania	159,000	180,000	205,000	5,018,000	2,404,000	1,628,000
Russia:						
Russia proper	19,176,000	17,326,000	19,767,000	1,583,201,000	1,500,000,000	1,022,484,000
Poland	925,000	903,000	948,000	70,000,000	70,000,000	42,450,000
Northern Caucasia	467,000	410,000	583,000	26,000,000	26,000,000	26,130,000
Total Russia (European)	20,568,000	18,639,000	21,298,000	1,679,201,000	1,596,000,000	1,091,064,000
Servia	....	....	....	1,601,000	1,032,000	1,100,000
Sweden	22,000	22,000	22,000	1,425,000	1,547,000	1,500,000
United Kingdom (Ireland)	....	....	....	26,089,000	17,745,000	16,080,000
Total	23,566,000	21,362,000	23,849,000	1,957,690,000	1,824,806,000	1,288,282,000
ASIA.						
British India, including such native States as report	17,008,000	6,528,000	11,908,000	....	....	....
Russia:						
Central Asia	b 545,000	b 495,000	966,000	27,000,000	27,000,000	51,864,000
Siberia	581,000	797,000	771,000	47,700,000	45,785,000	38,109,000
Transcaucasia	150,000	150,000	107,000	10,000,000	10,000,000	6,429,000
Total Russia (Asiatic)	1,276,000	1,442,000	1,844,000	84,700,000	82,785,000	96,402,000
Total Asia	18,284,000	7,970,000	13,752,000	84,700,000	82,785,000	96,402,000
AFRICA.						
Algeria	12,000	8,000	10,000	....	....	....
Grand total	102,960,000	100,850,000	107,643,000	2,042,390,000	1,907,591,000	1,384,684,000

a No official data. b Incomplete official returns.

FLAXSEED—Continued.

Acreage, production, value, etc., of flaxseed in the United States, 1902–1910.

Year.	Acreage sown and harvested.	Average yield per acre.	Production.	Average farm price Dec. 1.	Farm value Dec. 1.	Condition of growing crop.			
						July 1.	Aug. 1.	Sept. 1.	When harvested.
	Acres.	*Bushels.*	*Bushels.*	*Cents.*	*Dollars.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
1902	3,740,000	7.8	29,285,000	105.0	30,815,000	......	......	......	......
1903	3,233,000	8.4	27,301,000	81.7	22,292,000	86.2	80.3	80.5	74.0
1904	2,264,000	10.3	23,401,000	99.3	23,229,000	86.6	78.9	85.8	87.0
1905	2,535,000	11.2	28,478,000	84.4	24,049,000	92.7	96.7	94.2	91.5
1906	2,506,000	10.2	25,576,000	101.3	25,899,000	93.2	92.2	89.0	87.4
1907	2,864,000	9.0	25,851,000	95.6	24,713,000	91.2	91.9	85.4	78.0
1908	2,679,000	9.6	25,805,000	118.4	30,577,000	92.5	86.1	82.5	81.2
1909	2,742,000	9.4	25,856,000	152.6	39,466,000	95.1	92.7	88.9	84.9
1910	2,916,000	4.8	14,116,000	230.6	32,554,000	65.0	51.7	48.3	47.2

Acreage, production, and value of flaxseed in the United States in 1910, by States.

State.	Acreage.	Average yield per acre.	Production.	Average farm price Dec. 1.	Farm value Dec. 1.
	Acres.	*Bushels.*	*Bushels.*	*Dollars.*	*Dollars.*
Wisconsin	18,000	10.0	180,000	2.20	396,000
Minnesota	472,000	7.5	3,540,000	2.30	8,142,000
Iowa	16,000	12.2	195,000	2.20	429,000
Missouri	20,000	8.4	168,000	2.10	353,000
North Dakota	1,605,000	3.6	5,778,000	2.35	13,578,000
South Dakota	660,000	5.0	3,300,000	2.29	7,557,000
Nebraska	10,000	8.0	80,000	2.25	180,000
Kansas	50,000	8.2	410,000	2.10	861,000
Oklahoma	5,000	9.0	45,000	1.12	50,000
Montana	60,000	7.0	420,000	2.40	1,008,000
United States	2,916,000	4.8	14,116,000	2.306	32,554,000

Average farm price of flaxseed per bushel, on the first of each month, 1909–1910.

Month.	United States.		North Atlantic States.		South Atlantic States.		N. Cen. States East of Miss. R.		N. Cen. States West of Miss. R.		South Central States.		Far Western States.	
	1910.	1909.	1910.	1909.	1910.	1909.	1910.	1909.	1910.	1909.	1910.	1909.	1910.	1909.
	Cts.	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*
January	171.2	123.2	......	......	......	......	148.0	110.0	171.4	123.4	......	......	......	......
February	192.9	129.8	......	......	......	......	177.0	115.0	193.2	130.1	......	......	......	......
March	193.1	141.3	......	......	......	......	187.0	121.0	193.1	141.7	......	......	......	......
April	193.9	145.6	......	......	......	......	182.0	130.0	194.0	145.8	......	......	225.0	......
May	209.5	148.7	......	......	......	......	180.0	138.0	209.8	148.8	......	......	242.0	......
June	195.5	153.4	......	......	......	......	175.0	144.0	195.6	153.5	175.0	......	250.0	......
July	183.5	153.1	......	......	......	......	148.0	141.0	183.9	153.3	......	......	......	......
August	209.7	137.0	......	......	......	......	175.0	145.0	210.3	136.9	180.0	......	208.0	......
September	220.0	123.1	......	......	......	......	174.0	130.0	221.4	123.0	150.0	......	165.0	......
October	233.4	122.8	......	......	......	......	216.0	120.0	234.8	122.8	150.0	......	240.0	......
November	229.4	139.8	......	......	......	......	217.0	130.0	230.1	139.9	70.0	......	243.0	140.0
December	230.6	152.6	......	......	......	......	220.0	135.0	230.9	152.9	112.0	120.0	240.0	160.0

FLAXSEED—Continued.

Wholesale prices of flaxseed per bushel, 1897–1910.

Date.	St. Louis.		Cincinnati.		Chicago.		Milwaukee.		Duluth.	
	Prime.		Low.	High.	No. 1 and No. 1 Northwestern.		No. 1 Northwestern.		Low.	High.
	Low.	High.			Low.	High.	Low.	High.		
1897	$0.68	$1.13½	$0.65	$0.85	$0.71½	$1.22½	$0.75	$1.22¼	$0.71½	$1.21
1898	.84	1.36½	.80	.90	.85	1.39	.88	1.39	.86½	1.35
1899	.93	1.46	.90	1.00	.96½	1.51	.99	1.52	.90	1.42
1900	1.25	1.78	1.00	1.45	1.32	1.86	1.30	1.86	1.28½	1.87
1901	1.37	1.72	1.20	1.50	1.38	1.90	1.30	1.88	1.33	1.88
1902	1.11	1.65	1.25	1.40	1.13	1.80	1.18	1.80	1.15¼	1.73
1903	.86	1.17	1.00	1.30	.89	1.24	.94	1.24	.92	1.20
1904	.92½	1.18½	1.00	1.00	.97	1.28	1.06	1.28	1.01½	1.28
1905	.90	1.30	1.10	1.10	.92	1.47	.98	1.47	.96¼	1.50
1906	.98	1.19	1.10	1.12	1.03	1.25	1.05	1.25	1.09¼	1.25
1907.										
January	1.17	1.20	1.12	....	1.11½	1.24	1.18½	1.24½	1.17⅞	1.22⅜
February	1.18½	1.21	1.12	....	1.16	1.26	1.22½	1.24½	1.20¼	1.23½
March	1.15	1.18½	1.12	....	1.13	1.24	1.19	1.23	1.17¾	1.20¾
April	1.14	1.17½	1.12	....	1.11	1.23	1.16½	1.20	1.16¼	1.21
May	1.16	1.25½	1.12	....	1.14	1.30	1.19	1.26½	1.18½	1.27¾
June	1.24½	1.27	1.12	....	1.24	1.32	1.25	1.31	1.21¾	1.29½
July	1.06	1.10	1.12	....	1.18½	1.26	1.20	1.25	1.16¼	1.23½
August	1.00	1.10	1.12	....	1.07	1.20	1.16	1.20	1.11⅝	1.20
September	1.05	1.14	1.12	....	1.13½	1.28	1.19	1.27	1.21½	1.28¼
October	1.08	1.16	1.12	....	1.11	1.36½	1.16	1.34	1.22¼	1.41½
November	1.00	1.14	1.12	....	.96	1.21½	1.07	1.19	1.06½	1.22
December	1.02	1.10	1.12	....	.99½	1.20	1.07¾	1.14	1.08¾	1.17¼
Year	1.00	1.27	1.12	....	.96	1.36½	1.07	1.34	1.06½	1.41½
1908.										
January	1.11	1.18	1.12	....	1.09	1.22¼	1.15¾	1.20	1.14⅛	1.19
February	1.14	1.18½	1.12	....	1.06½	1.21½	1.16	1.19½	1.12¾	1.18
March	1.13	1.16	1.12	....	1.07¾	1.20½	1.17	1.20	1.14½	1.17
April	1.13½	1.17½	1.12	....	1.07	1.22	1.12	1.19½	1.14⅜	1.20
May	1.16	1.20	1.12	....	1.11½	1.25½	1.19	1.26	1.19⅞	1.24½
June	1.18	1.19½	1.12	....	1.14¾	1.25¾	1.21	1.26	1.20½	1.24½
July	1.00	1.12	1.12	1.15	1.14¾	1.27¼	1.21	1.23½	1.20⅞	1.25¾
August	1.00	1.20	1.15	1.25	1.17½	1.35½	1.23½	1.33	1.25¼	1.34¼
September	1.11	1.18	1.25	....	1.12¾	1.28⅝	1.23	1.28	1.21½	1.28⅝
October	1.12	1.19	1.25	....	1.12½	1.29¼	1.23	1.29	1.21½	1.28¼
November	1.19	1.35	1.25	....	1.18½	1.47	1.29	1.44¾	1.28⅛	1.46⅞
December	1.34	1.39½	1.25	....	1.33½	1.51½	1.42¼	1.47	1.41	1.49⅜
Year	1.00	1.39½	1.12	1.25	1.06½	1.51½	1.12	1.47	1.12¾	1.49⅜
1909.										
January	1.42½	1.51	1.25	....	1.44	1.61½	1.53¼	1.62¼	1.52	1.59½
February	1.50	1.63	1.25	....	1.50½	1.73½	1.60	1.71	1.58⅝	1.70⅞
March	1.55	1.63	1.25	....	1.52	1.71½	1.60¾	1.70	1.61	1.68⅝
April	1.53	1.60	1.75	....	1.53¼	1.69½	1.66	1.70	1.63¼	1.68¾
May	1.53½	1.66½	1.75	....	1.55	1.82	1.66½	1.80¾	1.64¾	1.82
June	1.50	1.65	1.75	....	1.54½	1.71½	1.64	1.78¼	1.75	1.81¾
July	1.20	1.50	1.75	....	1.29	1.65	1.40	1.66	1.39¾	1.79
August	1.15	1.35	1.75	....	1.35	1.45	1.35	1.45	1.38	1.50
September	1.32	1.38	1.75	....	1.32½	1.51	1.40	1.50	1.37½	1.47
October	1.35	1.60	1.75	....	1.32	1.73	1.42½	1.74¼	1.36½	1.74¼
November	1.55	1.72	1.75	....	1.56	1.84½	1.68	1.84	1.66½	1.84¾
December	1.68	1.90	1.75	....	1.70	1.99	1.80	2.09	1.76¾	2.04½
Year	1.15	1.90	1.25	....	1.29	1.99	1.35	2.09	1.36½	2.04½
1910.										
January	1.90	2.10	1.75	2.00	1.92	2.26	2.09	2.20	2.02	2.27
February	2.05	2.09	2.00	....	2.04	2.22	2.13	2.21	2.15¼	2.20¼
March	2.08	2.24	2.00	....	2.09½	2.35	2.18	2.35	2.17	2.35
April	2.18	2.30	2.00	....	2.20	2.43½	2.32	2.45	2.32	2.46
May	....	....	2.00	2.75	1.94½	2.42½	1.96	2.40	2.08	2.38¼
June	....	....	2.25	2.75	1.75	2.18	1.91½	2.20	1.89	2.20
July	1.80	2.18	2.25	2.75	1.97½	2.55	2.10	2.50	2.10	2.67
August	2.18	2.35	2.25	2.75	2.23	2.57½	2.40	2.55	2.42½	2.60
September	2.35	2.68	2.40	....	2.21	2.84	2.36	2.75	2.34	2.84
October	2.30	2.54	2.40	2.50	2.29	2.70	2.39	2.68	2.41¾	2.69
November	2.39	2.59	2.50	....	2.37	2.73	2.52	2.70	2.50	2.74
December	2.25	2.43	2.50	....	2.22½	2.57	2.32½	2.55	2.31½	2.54½
Year	1.80	2.68	1.75	2.75	1.75	2.84	1.91½	2.75	1.89	2.84

RICE.

Rice crop of countries named, 1905–1909.

[Mostly cleaned rice. The United States crop as given here is computed from the official returns, which are for rough rice, allowing 45 pounds rough to 1 bushel, and 162 pounds rough to 100 pounds cleaned. China, which is omitted, has a roughly estimated crop of 50,000,000,000 to 60,000,000,000 pounds. Other omitted countries are Afghanistan, Algeria, Colombia, Federated Malay States, Persia, Trinidad and Tobago, Turkey (Asiatic and European), Venezuela, and a few other countries of small production.]

Country.	1905.	1906.	1907.	1908.	1909.
NORTH AMERICA.					
United States:	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Contiguous	359,000,000	496,000,000	520,000,000	608,056,000	676,889,000
Noncontiguous—Hawaii[a]	33,400,000	33,400,000	33,400,000	33,400,000	33,400,000
Total United States (except Philippine Islands)	392,400,000	529,400,000	553,400,000	641,456,000	710,289,000
Central America:					
Guatemala[b]	1,300,000	1,300,000	1,300,000	1,300,000	1,300,000
Honduras[c]	8,100,000	8,100,000	8,100,000	8,100,000	8,100,000
Mexico	55,151,000	69,932,000	[d] 69,932,000	[d] 69,932,000	[d] 69,932,000
Total	456,951,000	608,732,000	632,732,000	720,788,000	789,621,000
SOUTH AMERICA.					
Argentina	[e] 2,000,000	[e] 2,000,000	17,808,000	[f] 19,000,000	[g] 19,000,000
Brazil: Sao Paulo[h]	83,000,000	83,000,000	83,000,000	83,000,000	83,000,000
British Guiana	32,800,000	56,000,000	[f] 59,000,000	71,300,000	[g] 71,300,000
Dutch Guiana	2,500,000	3,298,000	3,331,000	3,718,000	4,321,000
Peru	[i] 209,500,000	[i] 209,500,000	[i] 209,500,000	194,000,000	225,000,000
Total	329,800,000	353,798,000	372,639,000	371,018,000	402,621,000
EUROPE.					
Austria	300,000	200,000	....	....	....
Bulgaria	10,800,000	8,205,000	7,758,000	6,336,000	11,426,000
Greece	[j] 2,900,000	[j] 2,900,000	[j] 2,900,000	[j] 2,900,000	[k] 2,900,000
Italy	654,000,000	704,000,000	796,000,000	716,000,000	647,000,000
Spain	478,800,000	425,800,000	475,400,000	449,700,000	456,900,000
Total	1,146,800,000	1,141,105,000	1,282,058,000	1,174,936,000	1,118,226,000
ASIA.					
British India:[l]					
British Provinces	67,916,000,000	67,464,000,000	60,729,000,000	61,306,000,000	[m] 87,571,000,000
Native States	[f] 640,000,000	[f] 687,000,000	[f] 763,000,000	[g] 763,000,000	[n] 763,000,000
Total British India	68,556,000,000	68,151,000,000	61,492,000,000	62,069,000,000	88,334,000,000
Ceylon	392,000,000	283,000,000	333,000,000	309,000,000	320,000,000
French Indo-China[e]	5,000,000,000	5,000,000,000	5,000,000,000	5,000,000,000	5,000,000,000
Japanese Empire:					
Japan	11,920,000,000	14,459,285,000	15,317,905,000	16,217,500,000	[m] 16,474,000,000
Formosa	2,719,200,000	2,478,603,000	2,818,100,000	2,908,000,000	[g] 2,908,000,000
Total Japanese Empire	14,639,200,000	16,937,888,000	18,136,005,000	19,125,500,000	19,382,000,000
Java and Madura	6,268,000,000	6,953,000,000	6,877,000,000	[m] 7,200,000,000	[g] 7,200,000,000

a Census, 1899.
b Data for 1904.
c Data for 1901.
d Data for 1906.
e Average production as unofficially estimated.
f Estimated from official returns for acreage.
g Data for previous year.
h Official report for crop of 1904–5.
i Average 1908 and 1909.
j Data for 1909.
k Unofficial estimate.
l Data for British India refer to crop years beginning in the spring of the calendar years mentioned in this table. Production as given here, estimated unofficially for the entire country on the basis of official returns for about 0.7 of the area harvested.
m Preliminary.
n Data for 1907.

RICE—Continued.

Rice crop of countries named, 1905–1909—Continued.

Country.	1905.	1906.	1907.	1908.	1909.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Korea [a]	3,200,000,000	3,200,000,000	3,200,000,000	3,200,000,000	3,200,000,000
Philippine Islands	544,000,000	725,000,000	695,000,000	568,000,000	[b] 1,048,000,000
Russia, Asiatic: Caucasus and Central Asia	[c] 393,000,000	[c] 393,000,000	393,000,000	[d] 393,000,000	363,000,000
Siam [e]	6,824,000,000	6,824,000,000	6,824,000,000	6,824,000,000	6,824,000,000
Straits Settlements	[f] 93,000,000	[f] 94,000,000	[f] 79,000,000	[f] 77,000,000	[d] 77,000,000
Total	105,909,200,000	108,560,888,000	103,029,005,000	104,765,500,000	131,748,000,000
AFRICA.					
British Central Africa [g]	1,800,000	1,400,000	1,978,000	1,600,000	[d] 1,600,000
Egypt [h]	164,000,000	139,000,000	150,000,000	155,000,000	170,000,000
Madagascar	[i] 953,000,000	[i] 953,000,000	[i] 953,000,000	953,000,000	[d] 953,000,000
Total	1,118,800,000	1,093,400,000	1,104,978,000	1,109,600,000	1,124,600,000
OCEANIA.					
Fiji [h]	2,000,000	3,000,000	2,000,000	3,000,000	[d] 3,000,000
Grand total	108,963,551,000	111,760,923,000	106,423,412,000	108,144,842,000	135,186,068,000

[a] Estimated from official returns of exports of this country, and from per capita consumption of rice in Japan, 1894-1903, including food, seed, and waste, but not including rice used for saké (270 pounds per annum).
[b] Data for crop year beginning July 1 of calendar year mentioned.
[c] Data for 1907.
[d] Data for previous year.
[e] Data for 1903.
[f] Estimated from official returns for acreage.
[g] Includes only crops raised by natives.
[h] Estimated from official returns for acreage.
[i] Data for 1908.

Acreage, production, value, etc., of rice in the United States, 1904–1910.

Year.	Acreage sown and harvested.	Average yield per acre.	Production.	Average farm price Dec. 1.	Farm value Dec. 1.	Condition of growing crop.			
						July 1.	Aug. 1.	Sept. 1.	When harvested.
	Acres.	*Bushels.*	*Bushels.*	*Cents.*	*Dollars.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
1904	662,000	31.9	21,096,000	65.8	13,892,000	88.2	90.2	89.7	87.3
1905	460,000	28.1	12,933,000	95.0	12,286,000	88.0	92.9	92.2	89.3
1906	575,000	31.1	17,855,000	90.3	16,121,000	82.9	83.1	86.8	87.2
1907	627,000	29.9	18,738,000	85.8	16,081,000	88.7	88.6	87.0	88.7
1908	655,000	33.4	21,890,000	81.2	17,771,000	92.9	94.1	93.5	87.7
1909	720,000	33.8	24,368,000	79.4	19,341,000	90.7	84.5	84.7	81.2
1910	723,000	33.9	24,510,000	67.8	16,624,000	86.3	87.6	88.8	88.1

Acreage, production, and value of rice in the United States in 1910, by States.

State.	Acreage.	Average yield per acre.	Production.	Average farm price Dec. 1.	Farm value Dec. 1.
	Acres.	*Bushels.*	*Bushels.*	*Cents.*	*Dollars.*
North Carolina	1,000	26.5	27,000	75	20,000
South Carolina	17,000	21.0	357,000	75	268,000
Georgia	4,000	22.0	88,000	75	66,000
Florida	900	21.0	19,000	72	14,000
Alabama	1,000	25.0	25,000	70	18,000
Mississippi	2,800	30.0	84,000	70	59,000
Louisiana	371,200	34.4	12,769,000	67	8,555,000
Texas	264,800	33.0	8,738,000	68	5,942,000
Arkansas	60,000	40.0	2,400	70	1,680,000
California	100	33.0	3,000	65	2,000
United States	722,800	33.9	24,510,000	67.8	16,624,000

RICE—Continued.

Wholesale prices of rice per pound, 1897–1910.

Date.	New York.		Cincinnati.		Lake Charles.		New Orleans.		Houston.	
	Domestic (good).		Prime.[a]		Rough.[b]		Honduras, cleaned.		Head rice, cleaned.	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Dolls.*	*Dolls.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
1897	4 3/8	4 7/8	3 1/2	6 3/4	......	......	4 1/4	4 5/8	......	......
1898	4 7/8	5 5/8	5 1/2	7	......	......	4 1/4	5 1/2	......	......
1899	4 3/4	5 1/2	5 1/4	6 3/4	......	......	3 3/4	6 3/8	......	......
1900	4 3/4	5	5 1/2	6	......	......	3 3/4	6 5/8	......	......
1901	4 3/4	5	5 1/2	6 1/2	1.70	3.50	1 3/4	6 5/8	3	5
1902	4 3/4	5 1/4	5 1/4	6 1/2	1.75	3.40	1 1/2	6 1/2	3 1/2	5 3/4
1903	4 1/4	5 1/4	4 3/8	5 1/2	1.50	3.60	1 1/8	6 1/2	4	6 1/4
1904	3 3/8	4 1/4	3 3/4	5 1/4	1.00	3.00	1 1/16	5 1/4	3	4 3/4
1905	3 3/8	4 1/2	3	5 1/4	1.00	3.85	1	5 3/4	3	5
1906	4 7/8	5 1/2	4 1/2	5 1/2	2.00	3.85	1 1/8	6	3 1/2	5 3/4
1907.										
January	5	5 1/4	4 3/4	5 1/2	2.00	3.50	1 3/4	6	5	5 1/8
February	5	5 1/4	4 3/4	5 1/2	2.00	3.50	1 3/4	6	5 1/8	5 1/4
March	5	5 1/4	4 3/4	5 1/2	2.25	3.50	1 1/2	5 1/2	5 1/8	5 1/4
April	5 1/8	5 1/4	4 3/4	5 1/2	1.75	3.00	1 1/2	5 3/4	5 1/8	5 1/4
May	5 1/4	5 1/2	4 3/4	5 3/4	......	......	1 5/8	6	5 5/8	5 3/4
June	5 1/2	5 3/4	5	6	......	......	2 1/8	6 1/8	6	6
July	5 3/4	6	5	6	......	......	2 1/8	6 1/2	6 1/8	6 1/4
August	5 7/8	6	5	6	......	......	2	6 1/2	6 1/8	6 1/4
September	5 3/4	6	5	6	2.35	3.60	2 1/4	6 3/16	5 5/8	5 3/4
October	5 1/2	5 3/4	4 3/4	6	2.35	4.10	2	6 1/8	5 3/8	5 1/2
November	5 1/4	5 1/2	4 3/4	5 3/4	2.60	3.90	2	5 7/8	4 7/8	5 1/8
December	5	5 1/4	4 3/4	5 3/4	2.00	3.90	1 7/8	6	4 7/8	5 1/8
Year	5	6	4 3/4	6	1.75	4.10	1 1/2	6 1/2	4 7/8	6 1/4
1908.										
January	5	5 1/4	6 3/4	7 1/2	2.25	3.75	2	6	4 3/4	5 1/4
February	5 1/4	5 5/8	6 3/4	7 1/4	2.00	4.25	2	6 3/16	5	5 1/2
March	5 5/8	5 3/4	6 3/4	7 1/4	2.25	4.33	2 1/8	6 1/4	5	5 1/2
April	5 3/4	5 3/4	6 3/4	7 1/4	......	......	2 1/2	6 1/4	5 1/8	5 3/4
May	5 3/4	5 7/8	6 3/4	7 1/4	......	......	2 5/8	6 1/8	5 1/8	6
June	5 7/8	6 1/4	6 3/4	7 1/4	......	......	2 1/8	6 1/4	5 1/4	6 1/8
July	6 1/4	6 1/4	6 3/4	7 1/4	......	......	3	7 1/8	5 1/2	6 1/4
August	6 1/4	6 1/2	6 3/4	7 1/4	2.50	3.50	2 1/2	7	5 1/2	6
September	5 7/8	6	6 1/4	7 1/4	2.00	3.60	1 7/8	6	5 1/4	5 3/4
October	5 1/4	5 1/2	6 1/4	6 3/4	1.75	3.75	1 3/4	6	5	5 3/8
November	5	5 1/8	6 1/4	6 3/4	2.25	3.60	1 7/8	5 3/4	4 3/4	5 1/4
December	5	5 1/4	6 1/4	6 3/4	1.75	3.40	1 3/4	5 3/4	4 3/4	5 1/4
Year	5	6 1/2	6 1/4	7 1/2	1.75	4.33	1 3/4	7 1/8	4 3/4	6 1/4
1909.										
January	5	5 1/2	[c] 6 1/4	7	1.75	3.75	1 1/8	6	4 3/4	5 1/8
February	5 1/2	5 3/4	6 1/4	7.	2.00	3.63	1 7/8	6 3/16	4 7/8	5 1/4
March	5 3/4	5 3/4	6 1/4	7	2.25	3.63	2	6 1/8	4 7/8	5 3/8
April	5 3/4	5 3/4	6 1/2	7	2.25	3.60	2	6 1/8	5	5 1/2
May	5 3/4	5 7/8	6 1/4	7	2.00	3.40	2	6 5/16	5 1/8	5 1/2
June	5 3/4	5 7/8	6 1/4	7	1.75	3.00	1 7/8	6 1/8	5 1/4	5 3/4
July	5 1/2	5 3/4	6 1/4	7	......	......	1 7/8	6 1/2	5 1/2	6 1/8
August	[d] 5 3/4	[d] 6	6 1/4	7	......	......	1 3/4	6 3/8	5 1/2	5 3/4
September	5 1/8	5 1/4	6 1/4	7	1.50	3.25	1 1/4	5 7/8	5 1/4	5 5/8
October	5	5 1/8	6	7	2.00	3.50	1 1/2	6	5	5 3/8
November	4 7/8	5	6	6 1/2	1.75	3.25	1 3/4	5 5/8	4 5/8	5 1/4
December	4 3/4	4 7/8	6	6 1/2	1.50	3.30	1 5/8	5 3/4	4 5/8	5 1/8
Year	4 3/4	5 7/8	6	7	1.50	3.75	1 1/8	6 1/2	4 5/8	6 1/8
1910.										
January	4 7/8	5 1/8	6	6 1/2	1.75	3.25	1 3/8	6 1/8	3 1/4	5
February	4 3/4	4 7/8	6	6 1/2	1.75	3.25	1 1/2	6	3 5/8	5 1/8
March	4 1/2	4 3/4	6	6 1/2	1.60	3.00	1 1/4	5 1/2	3 1/4	4 5/8
April	4	4 1/4	6	6 1/2	1.55	2.65	1 3/8	5 1/8	3 1/8	4 1/2
May	4 1/4	4 1/2	6	6 1/2	1.60	2.50	1 1/8	6	3 1/8	4 7/8
June	4 1/4	4 1/2	6	6 1/2	1.60	2.75	1 5/8	5 3/8	3 3/8	4 1/2
July	4 3/8	4 1/2	6	6 1/2	1.60	2.65	1 3/8	6	3 1/2	4 1/2
August	4 1/4	4 5/8	6	6 1/2	1.60	2.85	1 3/4	5 7/8	4 1/4	5 3/4
September	4 1/2	4 5/8	6	6 1/2	1.75	3.10	1 3/4	5 3/8	3 1/4	5
October	4 3/8	4 1/2	6	6 1/2	1.75	2.80	1 5/8	5 1/8	3 1/2	5
November	4	4 1/4	6	6 1/2	1.75	3.15	1 3/8	4 7/8	3 1/4	4 1/2
December	4	4 1/8	6	6 1/2	1.75	2.75	1 9/16	4 3/4	3	4
Year	4	5 1/8	6	6 1/2	1.55	3.25	1 1/8	6 1/8	3	5 3/4

[a] Louisiana grade, 1897 to 1901. [b] Per barrel of 162 pounds. [c] Fancy head. [d] New crop.

RICE—Continued.

International trade in rice, 1905–1909.[a]

[Mostly cleaned rice.]

EXPORTS.

Country.	Year beginning—	1905.	1906.	1907.	1908.	1909.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Belgium	Jan. 1	41,923,262	73,215,968	61,676,146	84,552,734	121,549,309
British India	Jan. 1	5,110,049,504	4,284,929,600	4,294,019,202	3,736,183,475	3,822,116,099
Dutch East Indies	Jan. 1	98,247,103	100,703,857	116,357,243	126,513,678	[b] 123,322,524
Formosa	Jan. 1	221,561,825	161,759,068	119,264,963	221,473,132	213,352,080
France	Jan. 1	54,089,610	69,981,537	98,089,781	89,998,728	101,400,020
French Indo-China	Jan. 1	1,369,646,421	1,623,918,163	3,033,566,212	2,462,564,329	2,396,428,160
Germany [c]	Jan. 1	222,773,526	300,225,203	338,463,711	318,752,101	364,511,553
Netherlands	Jan. 1	282,611,808	295,873,665	315,264,586	375,562,261	384,880,186
Penang	Jan. 1	213,530,667	279,941,999	344,022,843	330,399,949	358,252,398
Siam	Jan. 1	1,835,880,400	1,921,339,467	1,779,013,333	2,037,902,086	2,111,915,900
Singapore	Jan. 1	672,031,467	689,046,531	677,447,819	855,164,354	896,436,185
Other countries		678,783,223	682,841,706	820,990,492	809,505,000	[b] 860,005,000
Total		10,801,128,816	10,483,776,764	11,998,176,331	11,448,571,827	11,754,169,414

IMPORTS.

Country.	Year beginning—	1905.	1906.	1907.	1908.	1909.
Austria-Hungary	Jan. 1	156,519,564	224,874,090	129,110,161	162,192,108	196,349,949
Belgium	Jan. 1	132,971,397	149,701,442	135,585,126	183,297,724	224,260,779
Brazil	Jan. 1	129,413,871	88,821,786	25,532,770	14,920,432	[d] 14,920,432
British India	Jan. 1	344,832,880	315,943,712	237,331,883	319,184,659	229,530,093
Ceylon	Jan. 1	714,172,144	731,312,784	741,024,347	607,870,320	637,524,600
China	Jan. 1	297,055,467	624,860,267	1,702,025,200	898,215,467	506,360,667
Cuba	Jan. 1	214,934,597	192,766,374	258,424,609	219,077,311	[b] 240,968,236
Dutch East Indies	Jan. 1	661,108,710	762,003,092	599,813,423	732,890,254	[b] 791,935,992
Egypt	Jan. 1	89,979,896	101,814,530	95,461,175	102,472,583	122,966,459
France	Jan. 1	375,080,970	387,572,768	345,988,355	444,436,902	555,721,075
Germany [c]	Jan. 1	627,278,011	671,849,295	750,601,700	1,096,182,896	690,417,810
Japan	Jan. 1	1,546,121,733	813,478,133	902,701,867	647,138,933	441,747,600
Mauritius	Jan. 1	114,012,106	134,012,761	131,022,323	131,263,223	139,881,696
Netherlands	Jan. 1	493,955,916	561,916.461	566,643,424	673,530,815	734,620,212
Penang	Jan. 1	263,046,133	276,500,933	292,286,300	358,425,970	411,705,534
Philippine Islands	Jan. 1	483,411,974	280,101,412	262,399,906	349,175,386	368,442,959
Russia	Jan. 1	177,144,824	210,598,294	193,910,846	249,485,657	[b] 63,705,208
Singapore	Jan. 1	816,150,667	810,458,665	803,864,402	964,541,386	1,020,659,456
United Kingdom	Jan. 1	685,939,744	768,403,216	584,189,968	618,651,635	625,626,654
United States	Jan. 1	109,544,299	209,152,583	203,560,814	217,345,410	225,710,483
Other countries		1,195,514,115	1,284,847,364	1,241,719,828	1,282,690,000	[b] 1,342,530,000
Total		9,628,189,018	9,600,989,962	10,203,198,427	10,272,989,071	9,585,585,894

[a] See "General note," p. 507.
[b] Preliminary.
[c] Not including free ports prior to March 1, 1906.
[d] Year preceding.

HOPS.

Hop crop of countries named, 1906–1910.

[Excluding Canada, for which the census of 1901 shows a production in the preceding year of 1,004,216 pounds. Other omitted countries are of very small production.]

Country.	1906.	1907.	1908.	1909.	1910.
NORTH AMERICA.					
United States: [a]	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
New York	12,006,000	9,000,000	8,000,000	9,000,000	9,000,000
California	15,520,000	15,000,000	12,000,000	13,000,000	13,000,000
Oregon	23,985,000	23,000,000	16,000,000	15,000,000	18,000,000
Washington	8,775,000	7,000,000	3,000,000	3,000,000	4,000,000
Total	60,286,000	54,000,000	39,000,000	40,000,000	44,000,000
EUROPE.					
Austria-Hungary:					
Austria	15,012,000	29,975,000	41,331,000	18,706,000	[b] 35,310,000
Hungary	1,647,000	2,254,000	1,913,000	1,643,000	[c] 2,860,000
Total Austria-Hungary	16,659,000	32,229,000	43,244,000	20,349,000	38,170,000
Belgium	7,705,000	6,790,000	8,530,000	3,000,000	[b] 6,000,000
France	9,156,000	8,672,000	11,369,000	3,000,000	[b] 6,653,000
Germany	46,384,000	53,255,000	58,069,000	13,356,000	44,998,000
Netherlands [d]	158,000	158,000	158,000	158,000	158,000
Russia	10,834,000	12,639,000	9,750,000	8,267,000	[b] 6,430,000
United Kingdom: England	27,517,000	41,902,000	52,725,000	24,022,000	33,900,000
Total	118,413,000	155,645,000	183,845,000	72,152,000	136,309,000
AUSTRALASIA.					
Australia:					
Victoria	213,000	312,000	132,000	123,000	[c] 123,000
Tasmania	989,000	1,356,000	1,402,000	1,336,000	[c] 1,336,000
New Zealand	[e] 1,097,000	[e] 1,100,000	[e] 941,000	[e] 749,000	[c] 749,000
Total	2,299,000	2,768,000	2,475,000	2,208,000	2,208,000
Grand total	180,998,000	212,413,000	225,320,000	114,360,000	182,517,000

[a] Estimate based upon reports to California Fruit Grower and American Agriculturist.
[b] Preliminary.
[c] Year preceding.
[d] Estimated average, 1900–1903.
[e] Estimate based on the official figures of area, multiplied by yield as given in census of 1895, 1,088 pounds.

HOPS—Continued.

Wholesale prices of hops per pound, 1897–1910.

Date.	New York. Choice State. Low.	New York. Choice State. High.	Cincinnati. Choice. Low.	Cincinnati. Choice. High.	Chicago. Pacific coast, good to choice.[a] Low.	Chicago. Pacific coast, good to choice.[a] High.
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
1897	7	18	8	18	6	17
1898	11	20	14	20	5	19½
1899	12	18	13	19	7	18
1900	12½	21	10	18	6½	18
1901	13	20	13¾	17 9/10	12½	19
1902	14	38	14½	30	12½	31
1903	20½	37	24	29½	19	31
1904	32	41	28	37	28½	37
1905	13	37	13½	33	10	34
1906	11	25	12	18½	9	22
1907.			(b)		(c)	
January	21	23	16½	......	12	18
February	21	23	16½	......	12	17
March	21	23	14½	......	10	15
April	15	20	13	......	8	12
May	15	16	13	......	10	13
June	15	16	14	......	8	12
July	15	16	13½	......	7	11
August	14	16	12½	......	6	9
September	12	15	12	......	10	13
October	12	18	12	......	9	13
November	16	18	12	......	8	12
December	16	17	12	......	8	11
Year	12	23	12	......	6	18
1908.					(d)	
January	15	16	10	......	8	11
February	13	16	9½	......	6	10
March	11	14	9	......	6	9
April	11	12	8½	......	6	8
May	11	12	8½	......	6	10
June	9	12	8½	......	6	10
July	7	11	8½	......	5	9
August	6	8	8	......	5	8
September	6	7	8	......	9	11

Date.	New York. Choice State. Low.	New York. Choice State. High.	Cincinnati. Prime. Low.	Cincinnati. Prime. High.	Chicago. Pacific coast, good to choice. Low.	Chicago. Pacific coast, good to choice. High
1908.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents*
October	13	14	12	......	9	11
November	13	14	11	......	9	11
December	12	14	11	......	9	11
Year	6	16	8	......	5	11
1909.						
January	12	14	10	......	10	11
February	12	15	10	......	10	11
March	13	15	11	......	10	11½
April	13	15	11	......	9	11
May	13	14	11	......	10	12
June	13	17	13	......	13	15
July	15	19	14	15	13	15
August	18	19	16	17	16	18
September	18	19	20	22	25	28
October	33	39	28	......	25	29
November	34	39	28	......	24	28
December	33	36	27	28	23	27
Year	12	39	10	28	9	29
1910.						
January	33	35	25½	27½	20	26
February	32	35	25½	26½	22	26
March	28	34	24½	25½	22	24
April	24	29	24	24½	17	19
May	23	25	20	21	16	18
June	22	24	16	17	16	18
July	22	23	16	17½	14	16
August	21	23	16	17½	14	16
September	21	22	16½	......	14	16
October	21	23	15½	16½	16	17
November	22	23	16	17½	15	17
December	21	25	17½	18½	15	18
Year	21	35	15½	27½	14	26

a Common to choice, 1897 to 1903.
b Prime.
c Prime to choice.
d Pacific coast, good to choice.

HOPS—Continued.

International trade in hops, 1905–1909.[a]

EXPORTS.

Country.	Year beginning—	1905.	1906.	1907.	1908.	1909.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Austria-Hungary	Jan. 1	18,777,206	12,365,284	17,826,133	15,498,272	17,834,112
Belgium	Jan. 1	2,582,318	3,178,692	2,166,826	1,403,039	2,508,319
France	Jan. 1	606,364	382,722	386,691	152,339	163,802
Germany [b]	Jan. 1	22,855,096	26,767,198	22,540,055	27,341,943	19,408,417
Netherlands	Jan. 1	1,256,989	1,534,058	1,561,238	1,771,156	1,442,399
New Zealand	Jan. 1	369,712	493,360	288,176	170,016	347,984
Russia	Jan. 1	1,140,117	1,978,368	681,990	241,342	[c] 2,600,122
United Kingdom	Jan. 1	1,820,448	1,300,096	1,168,720	1,059,632	1,750,896
United States	Jan. 1	5,713,682	17,701,436	16,090,959	21,423,869	8,955,533
Other countries	....	63,125	140,828	258,296	98,000	[c] 226,000
Total	....	55,185,057	65,842,042	62,969,084	69,159,608	55,237,584

IMPORTS.

Country.	Year beginning—	1905.	1906.	1907.	1908.	1909.
Australia	Jan. 1	1,279,362	1,412,569	1,020,898	973,814	847,791
Austria-Hungary	Jan. 1	1,187,189	1,346,363	773,602	553,360	585,321
Belgium	Jan. 1	6,617,221	5,431,355	5,577,912	6,025,351	6,630,010
British India	Jan. 1	485,184	307,216	470,736	363,888	300,944
British South Africa [d]	Jan. 1	308,112	657,888	588,672	543,984	435,344
Canada	Jan. 1	964,962	699,630	1,223,478	1,205,845	1,245,446
Denmark	Jan. 1	1,378,660	1,297,861	1,293,011	1,340,961	1,102,520
France	Jan. 1	3,879,328	4,386,095	4,297,911	4,907,929	5,725,567
Germany [b]	Jan. 1	9,047,989	4,865,380	6,666,336	6,154,864	8,016,587
Netherlands	Jan. 1	3,368,742	3,497,750	3,372,957	3,386,709	2,946,876
Russia	Jan. 1	1,199,162	1,452,240	1,395,110	1,283,377	[c] 1,047,271
Sweden	Jan. 1	1,662,563	1,275,477	1,488,832	1,166,003	974,140
Switzerland	Jan. 1	1,347,685	1,087,540	1,421,540	1,289,704	874,785
United Kingdom	Jan. 1	11,147,584	25,702,992	21,902,048	29,922,256	15,030,512
United States	Jan. 1	5,968,533	7,849,548	7,163,356	7,367,684	6,807,689
Other countries	....	2,514,950	4,107,343	3,465,556	3,809,000	[c] 3,629,000
Total	....	52,357,226	65,377,247	62,121,955	70,294,729	56,199,803

[a] See "General note," p. 507.
[b] Not including free ports prior to March 1, 1906.
[c] Preliminary.
[d] Cape Colony before 1906.

BEANS.

Wholesale prices of beans per bushel, 1897–1910.

Date.	Boston.		Cincinnati.		Chicago.		Detroit.		San Francisco.	
	Pea.		Navy.		Pea.		Pea.		Small white (per 100 lbs.).	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.
1897	....	....	$0.70	$1.20	$0.35	$1.25	$0.60	$1.05	....	....
1898	....	....	1.10	1.55	.78	1.30	.90	1.30	$1.25	$2.20
1899	....	....	1.05	1.75	.90	1.87	1.01	1.80	2.00	3.00
1900	....	....	2.00	2.55	1.65	2.25	1.55	2.10	2.85	4.50
1901	$2.00	$2.75	2.40	3.00	.90	2.80	1.66	2.40	2.00	5.00
1902	1.60	2.55	2.20	2.70	.85	2.49	1.28	1.98	3.30	4.65
1903	2.10	2.45	2.05	2.50	.90	2.40	1.82	2.35	2.40	3.40
1904	1.72½	2.20	1.80	2.10	.90	2.05	1.58	1.98	2.75	3.32½
1905	1.75	2.00	1.65	1.90	1.00	1.85	1.49	1.85	2.75	3.60
1906	1.50	1.80	1.65	1.75	1.10	1.65	1.27	1.61	....	....
1907.					(a)					
January	1.50	1.50	1.65	1.75	1.20	1.38	1.28	1.31	2.60	2.95
February	1.50	1.55	1.65	1.70	1.10	1.39	1.31	1.36	2.60	3.00
March	1.45	1.55	1.65	1.70	1.10	1.36	1.30	1.36	2.75	3.00
April	1.42	1.47	1.65	1.75	1.10	1.35	1.32	1.36	2.85	3.10
May	1.45	1.90	1.65	1.75	1.10	1.77	1.38	1.73	2.80	3.05
June	1.80	1.90	1.65	1.75	1.55	1.83	1.64	1.74	2.80	3.00
July	1.70	1.75	1.65	1.70	1.15	1.68	1.50	1.65	2.75	3.00
August	1.70	1.80	1.65	1.70	1.15	1.85	1.48	1.60	2.85	3.00
September	1.90	2.25	1.65	1.70	1.35	2.25	1.75	2.06	2.85	3.15
October	2.35	2.45	1.65	1.70	1.85	2.40	2.00	2.25	3.00	3.60
November	2.45	2.45	1.65	2.25	1.85	2.65	1.90	2.10	3.40	3.60
December	2.30	2.40	2.00	2.25	1.85	2.15	1.90	2.00	3.40	3.55
Year	1.42	2.45	1.65	2.25	1.10	2.65	1.28	2.25	2.60	3.60
1908.					(b)					
January	2.30	2.35	2.00	2.25	1.85	2.15	2.00	2.10	3.40	3.55
February	2.35	2.40	2.00	2.25	1.75	2.40	2.10	2.30	3.40	3.60
March	2.30	2.40	2.25	2.40	1.80	2.40	2.10	2.25	3.40	3.60
April	2.35	2.45	2.30	2.40	1.65	2.32	2.25	2.42	3.40	3.60
May	2.60	2.75	2.30	2.40	1.65	2.70	2.42	2.55	3.50	4.35
June	2.65	2.75	2.30	2.40	2.00	2.70	2.47	2.60	4.20	4.50
July	2.65	2.70	2.30	2.40	2.00	2.65	2.40	2.65	4.35	4.60
August	2.60	2.70	2.30	2.40	1.90	2.54	2.50	2.65	4.60	4.75
September	2.35	2.60	2.30	2.40	1.75	2.40	2.05	2.40	4.25	4.75
October	2.35	2.40	2.30	2.40	1.75	2.40	2.10	2.18	4.00	4.50
November	2.40	2.40	2.30	2.40	1.75	2.25	2.10	2.20	4.30	4.65
December	2.35	2.40	2.30	2.40	1.75	2.27	2.15	2.15	4.35	4.70
Year	2.30	2.75	2.00	2.40	1.65	2.70	2.00	2.65	3.40	4.75
1909.					(a)					
January	2.35	2.45	2.30	2.40	1.75	2.33	2.15	2.30	4.50	4.90
February	2.45	2.55	2.30	2.40	1.80	2.50	2.25	2.40	5.10	5.30
March	2.55	2.55	2.30	2.40	2.20	2.48	2.35	2.40	5.20	5.40
April	2.50	2.55	2.30	2.40	2.25	2.58	2.36	2.50	5.35	5.65
May	2.55	2.75	2.40	2.75	2.35	2.65	2.50	2.55	5.50	6.00
June	2.70	2.75	2.60	2.75	2.50	2.67	2.50	2.55	6.00	7.00
July	2.70	2.75	2.60	2.75	2.12½	2.67	2.20	2.50	6.25	7.00
August	2.60	2.70	2.60	2.75	2.12½	2.20	2.15	2.20	6.75	7.50
September	2.35	2.50	2.60	2.75	2.12½	2.36	2.10	2.20	4.00	4.50
October	2.30	2.40	2.60	2.75	2.00	2.36	2.00	2.10	4.00	4.65
November	2.25	2.35	2.60	2.75	1.96	2.25	2.00	2.10	4.50	5.00
December	2.25	2.30	2.60	2.75	2.03	2.17	2.55	2.55	4.50	5.00
Year	2.25	2.75	2.30	2.75	1.75	2.67	2.00	2.55	4.00	7.50
1910.										
January	2.25	2.35	....	....	2.10	2.30	2.07	2.20	4.50	4.85
February	2.35	2.40	....	....	2.17	2.25	2.12	2.15	4.50	4.80
March	2.30	2.35	....	....	2.10	2.22	2.08	2.15	4.50	4.85
April	2.25	2.30	....	....	2.00	2.16	2.03	2.08	4.25	4.85
May	2.27½	2.40	....	....	2.10	2.35	2.05	2.20	4.25	4.60
June	2.40	2.45	....	....	2.15	2.40	2.22	2.30	4.00	4.50
July	2.45	2.45	....	....	2.30	2.50	2.22	2.32	3.85	4.25
August	2.45	2.60	....	....	2.43	2.78	2.32	2.40	3.85	4.10
September	2.65	2.70	....	....	2.35	2.78	2.15	2.40	3.85	4.10
October	2.45	2.65	....	....	2.00	2.55	2.02	2.15	3.60	3.90
November	2.35	2.40	....	....	2.00	2.30	2.00	2.10	3.25	3.80
December	2.30	2.35	....	....	1.85	2.30	1.92	2.09	3.25	3.50
Year	2.25	2.70	....	....	1.85	2.78	1.92	2.40	3.25	4.85

[a] Common to fine.

[b] Pea.

SUGAR.

Sugar production of countries named, 1906–7 to 1910–11.

[European beet sugar, as estimated by Licht; United States beet sugar, from reports of Department of Agriculture on the Progress of the Beet-Sugar Industry in the United States; production of British India, except 1910-11, from official statistics; other data, from Willett & Gray. The estimates of Willett & Gray do not include the production of China and some other less important sugar-producing countries.]

Country.	1906–7.	1907–8.	1908–9.	1909–10.	1910–11.[a]
CANE SUGAR.					
NORTH AMERICA.					
United States:					
Contiguous—	*Tons.*[b]	*Tons.*[b]	*Tons.*[b]	*Tons.*[b]	*Tons.*[b]
Louisiana	230,000	340,000	355,000	325,000	300,000
Texas	13,000	12,000	15,000	10,000	11,000
Noncontiguous—					
Hawaii	392,871	465,288	477,817	462,613	485,000
Porto Rico	210,000	200,000	245,000	308,000	320,000
Total United States (except Philippine Islands)	845,871	1,017,288	1,092,817	1,105,613	,116,000
Central America:					
Costa Rica	2,365	2,415	2,245	2,500	2,500
Guatemala	7,469	7,178	7,260	7,500	7,500
Nicaragua	3,905	4,175	3,950	4,500	4,500
Salvador	6,008	5,490	6,241	6,500	6,500
Mexico	119,496	123,285	143,179	160,000	170,000
West Indies:					
British—					
Antigua and St. Kitts	28,319	20,000	19,000	20,000	20,000
Barbados[c]	32,950	31,852	13,128	35,000	40,000
Jamaica[c]	13,971	10,718	11,453	12,000	12,000
Trinidad[c]	45,631	41,626	44,512	45,000	45,000
Cuba	1,427,673	961,958	1,513,582	1,804,349	1,900,000
Danish—St. Croix	13,000	13,000	14,000	15,000	15,000
French—					
Guadeloupe	38,960	37,500	25,211	43,000	43,000
Martinique[c]	36,764	35,943	37,757	40,000	40,000
Haiti and Santo Domingo	60,000	60,000	69,483	93,000	100,000
Other	5,662	5,000	8,000	8,000	8,000
Total	2,688,044	2,377,428	3,011,818	3,401,962	3,530,000
SOUTH AMERICA.					
Argentina	116,287	109,445	162,479	125,000	130,000
Brazil	215,000	180,000	248,000	253,000	310,000
British Guiana[c]	120,334	99,737	117,176	101,843	100,000
Dutch Guiana	13,000	13,000	11,000	13,000	13,000
Peru	161,156	135,336	150,000	150,000	150,000
Venezuela	3,000	3,000	3,000	3,000	3,000
Total	628,777	540,518	691,655	645,843	706,000
EUROPE.					
Spain	16,400	11,000	21,669	23,033	24,000
ASIA.					
British India[d]	2,205,300	2,046,900	1,872,900	2,125,300	2,100,000
Formosa	81,448	68,450	122,000	160,000	230,000
Java	1,011,546	1,156,477	1,241,885	1,200,618	1,175,000
Philippine Islands	145,500	150,000	129,015	120,000	150,000
Total	3,443,794	3,421,827	3,365,800	3,605,918	3,655,000
AFRICA.					
Egypt	42,195	55,648	34,835	45,000	45,000
Mauritius	220,000	170,000	205,758	244,597	190,000
Natal	27,130	24,222	31,992	62,000	76,000
Reunion	37,500	35,000	39,500	40,000	40,000
Total	326,825	284,870	312,085	391,597	351,000

[a] Preliminary.
[b] Tons of 2,240 pounds, except beet sugar in Europe, which is shown in metric tons of 2,204.6 pounds.
[c] Exports.
[d] Official estimates for such parts of British India as return statistics of production.

SUGAR—Continued.

Sugar production of countries named, 1906-7 to 1910-11—Continued.

Country.	1906-7.	1907-8.	1908-9.	1909-10.	1910-11.
OCEANIA.					
Australia:	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Queensland	182,000	188,307	151,098	134,584	175,000
New South Wales	24,000	23,418	15,000	14,750	15,000
Fiji [a]	43,000	69,000	65,000	68,900	66,000
Total	249,000	280,725	231,098	218,234	256,000
Grand total, cane sugar	7,352,840	6,916,368	7,634,125	8,291,587	8,522,000
BEET SUGAR.					
NORTH AMERICA.					
United States	431,796	413,954	380,254	457,562	[b] 510,000
Canada	11,367	7,943	6,964	8,802	8,704
Total	443,163	421,897	387,218	466,364	518,704
EUROPE.					
Austria-Hungary	1,343,940	1,424,657	1,398,588	1,257,000	1,600,000
Belgium	282,804	232,352	258,339	250,000	285,000
France	756,094	727,712	807,059	801,000	750,000
Germany	2,239,179	2,129,597	2,082,848	2,027,000	2,572,000
Netherlands	181,417	175,184	214,344	198,000	225,000
Russia	1,440,130	1,410,000	1,257,387	1,145,000	2,075,000
Other countries	467,244	462,772	525,300	460,000	550,000
Total	6,710,808	6,562,274	6,543,865	6,138,000	8,057,000
Grand total, beet sugar	7,153,971	6,984,171	6,931,083	6,604,364	8,575,704
Grand total, cane and beet sugar	14,506,811	13,900,539	14,565,208	14,895,951	17,097,704

[a] Exports. [b] Preliminary.

Production of sugar in the United States and its possessions, 1839-40 to 1909-10.

[Census data, as far as available, are given in *italics*. Census of 1840 did not separate cane and maple sugar; statistics for "Other Southern States" represent production of all sugar in South Carolina, Georgia, Florida, Tennessee, Alabama, and Mississippi. Censuses of 1850 and 1860 give returns in "Hogsheads of 1,000 pounds" and Censuses of 1870 and 1880 in "Hogsheads;" these returns were converted into pounds, in Census Abstract of 1890 at rate of 1,200 pounds to the hogshead and in Census of 1900 at rate of 1,000 pounds. Beet-sugar production for 1897-98 from Special Report of Department of Agriculture; for 1901-2 and later years from Progress of the Beet-Sugar Industry in the United States; for other years from Willett & Gray. Production of cane sugar in Louisiana beginning 1906-7, and in Texas beginning 1903-4, from Willett & Gray; earlier statistics for Louisiana and other southern States from Bouchereau, in part taken directly from his reports and in part from the Statistical Abstract of the United States. Porto Rican production of cane sugar for 1854-55 to 1884-85 from Rueb & Co.; for later years from Willett & Gray. Statistics for Hawaii, 1874-75 to 1880-81, represent exports, from Bureau of Statistics Bul. 30; for 1881-82 to 1884-85 from Rueb & Co.; for later years from Willett & Gray. Statistics for Philippine Islands for 1854-55 to 1857-58, 1859-60 to 1866-67, 1872-73 to 1894-95 represent exports as officially returned, taken from the Census of the Philippine Islands, 1903; for 1858-59, 1867-68 to 1871-72 from Foreign Markets Bul. 14, representing commercial estimates of exports; subsequently from Willett & Gray, the statistics for 1904-5 to 1907-8 representing production, other years, production. Ton, 2,240 pounds.]

Year.	Beet sugar.	Cane sugar.					Total.
		Louisiana.	Other Southern States.	Porto Rico.	Hawaii.	Philippine Islands.	
	Long tons.	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*
1839-40 (Census)		*53,548*	*403*				
		Hogsheads.	*Hogsheads.*				
1849-50 (Census)		*226,001*	*21,576*				
		Long tons.	*Long tons.*				
1854-55		171,976	13,169	58,377		35,008	278,530
1855-56		113,647	9,821	82,000		47,397	252,865
1856-57		36,327	2,673	85,000		36,066	160,066
1857-58		137,351	6,385	69,444		26,858	240,038
1858-59		185,177	8,169	58,000		50,095	301,441
1859-60		113,891	5,149	57,000		49,013	225,053

SUGAR—Continued.

Production of sugar in the United States and its possessions, 1839–40 to 1909–10—Con.

Year.	Beet sugar.	Cane sugar.					Total.
		Louisiana.	Other Southern States.	Porto Rico.	Hawaii.	Philippine Islands.	
	Long tons.	*Hogsheads.*	*Hogsheads.*	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*
1859–60 (Census)	....	*221,726*	*9,256*	....	....	....	....
		Long tons.	*Long tons.*				
1860–61	....	118,332	4,313	67,000	....	45,316	234,961
1861–62	....	235,858	5,138	68,000	....	60,957	369,953
1862–63	....	43,232	2,768	63,000	....	51,240	160,240
1863–64		37,723	250	61,590	....	44,325	144,288
1864–65		4,821	179	63,375	....	46,092	114,867
1865–66		8,884	348	64,417	....	40,636	114,685
1866–67		19,152	3,348	68,229	....	55,195	146,324
1867–68		18,482	4,518	73,935	....	74,081	171,416
1868–69	*a* 400	42,434	2,567	81,500	....	68,818	195,719
1869–70		44,399	2,402	102,110	....	78,214	227,525
		Hogsheads.	*Hogsheads.*				
1869–70 (Census)		*80,706*	*6,337*	....	....	....	....
		Long tons.	*Long tons.*				
1870–71		75,392	4,208	103,304	....	87,465	270,769
1871–72		65,583	4,217	89,559	....	95,526	255,285
1872–73	500	55,958	4,235	87,639	....	83,865	232,197
1873–74	700	46,090	2,410	71,755	....	99,770	220,725
1874–75		60,047	3,454	72,128	11,197	126,089	273,015
1875–76	*b* 100	72,954	4,046	70,016	11,639	128,485	287,240
1876–77		85,122	3,879	62,340	11,418	121,052	283,911
1877–78		65,671	5,330	84,347	17,157	120,096	292,701
1878–79	200	106,910	5,090	76,411	21,884	129,777	340,272
1879–80	1,200	88,822	3,980	57,057	28,386	178,329	357,774
		Hogsheads.	*Hogsheads.*				
1879–80 (Census)	....	*171,706*	*7,166*	....	....	....	....
		Long tons.	*Long tons.*				
1880–81	500	121,867	5,500	61,715	41,870	205,508	436,960
1881–82	*b* 500	71,373	5,000	80,066	50,972	148,047	355,958
1882–83		135,297	7,000	77,632	51,705	193,726	465,860
1883–84	535	128,443	6,800	98,665	63,948	120,199	418,590
1884–85	953	94,376	6,500	70,000	76,496	200,997	449,322
1885–86	600	127,958	7,200	64,000	96,500	182,019	478,277
1886–87	800	80,859	4,535	86,000	95,000	169,040	436,234
1887–88	255	157,971	9,843	60,000	100,000	158,445	486,514
1888–89	1,861	144,878	9,031	62,000	120,000	224,861	562,631
1889–90	2,203	128,344	8,159	55,000	120,000	142,554	456,260
1889–90 (Census)	....	*130,413*	*4,089*	....	....	....	....
1890–91	3,459	215,844	6,107	50,000	125,000	136,035	536,445
1891–92	5,356	160,937	4,500	70,000	115,598	248,806	605,197
1892–93	12,018	217,525	5,000	50,000	140,000	257,392	681,935
1893–94	19,950	265,836	6,854	60,000	136,689	207,319	696,648
1894–95	20,092	317,334	8,288	52,500	131,698	336,076	865,988
1895–96	29,220	237,721	4,973	50,000	201,632	230,000	753,546
1896–97	37,536	282,009	5,570	58,000	224,218	202,000	809,333
1897–98	40,398	310,447	5,737	54,000	204,833	178,000	793,415
1898–99	32,471	245,512	3,442	53,826	252,507	93,000	680,758
1898–99 (Census)	....	*248,658*	*c 5,266*	....	....	....	....
1899–1900	72,944	147,164	2,027	35,000	258,521	62,785	578,441
1899–1900 (Census)	*72,972*	*142,485*	*1,510*	....	*242,008*	....	....
1900–1901	76,859	275,579	2,891	80,000	321,461	55,400	812,190
1901–2	164,827	321,676	3,614	85,000	317,509	78,637	971,263
1902–3	195,005	329,227	3,722	85,000	391,062	90,000	1,094,016
1902 (Census)	....	....	....		....	*177,371*	....
1903–4	214,825	228,477	*c* 19,800	130,000	328,103	84,000	1,005,205
1904–5	216,173	355,531	*c* 15,000	145,000	380,576	106,875	1,219,155
1904–5 (Census)	*226,715*	....	....	....	....	....	....
1905–6	279,393	336,752	*c* 12,000	213,000	383,225	145,525	1,369,895
1096–7	431,796	230,000	*c* 13,000	210,000	392,871	145,500	1,423,167
1907–8	413,954	340,000	*c* 12,000	200,000	465,288	150,000	1,581,242
1908–9	380,254	355,000	*c* 15,000	245,000	477,817	129,015	1,602,086
1909–10	457,562	325,000	*c* 10,000	308,000	462,613	120,000	1,683,175
1910–11	*d* 455,000	300,000	*c* 11,000	320,000	485,000	150,000	*d* 1,721,000

a Mean annual production; quantity varied from year to year between 300 and 500 tons.
b Production uncertain; not exceeding quantity stated.
c Texas.
d Preliminary.

SUGAR—Continued.

International trade in sugar, 1905–1909. [a]

EXPORTS.

Country.	Year beginning—	1905.	1906.	1907.	1908.	1909.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Argentina	Jan. 1	4,847,964	233,690	140,653	40,622	87,576
Austria-Hungary	Jan. 1	1,265,791,878	1,631,945,421	1,618,876,642	1,769,027,274	1,757,062,893
Belgium	Jan. 1	304,193,682	462,976,753	381,085,086	293,991,033	321,161,159
Brazil	Jan. 1	83,216,786	7,278,992	28,346,807	69,616,218	[b] 154,780,081
British Guiana	Apr. 1	261,072,000	257,490,240	225,650,880	258,077,120	243,118,400
British India	Jan. 1	60,302,704	46,609,920	46,583,376	46,355,008	36,905,904
China	Jan. 1	69,228,800	59,815,600	47,729,733	75,818,000	123,619,867
Cuba	Jan. 1	2,412,915,391	2,643,700,975	2,910,438,045	1,991,015,068	[b] 3,206,646,443
Dutch East Indies	Jan. 1	2,314,655,085	2,197,208,868	2,632,250,558	2,823,722,228	[b] 2,782,634,830
Egypt	Jan. 1	67,821,106	10,495,854	9,206,628	8,638,977	9,987,436
Formosa	Jan. 1	93,930,689	147,283,970	124,809,731	137,148,777	277,482,654
France	Jan. 1	658,062,149	617,793,487	731,268,080	540,824,641	535,757,483
Germany [c]	Jan. 1	1,636,803,746	2,671,855,698	2,015,279,142	1,842,130,114	1,882,598,329
Mauritius	Jan. 1	361,987,596	410,919,376	431,348,726	434,420,571	395,403,344
Netherlands	Jan. 1	215,001,603	360,050,106	299,971,063	339,798,814	336,095,311
Peru	Jan. 1	295,935,805	301,435,777	243,864,933	[b] 275,339,651	[d] 275,339,651
Philippine Islands	Jan. 1	239,196,273	285,393,647	282,006,295	319,082,784	285,116,244
Reunion	Jan. 1	41,433,135	80,424,062	102,514,264	104,133,256	[d] 104,133,256
Russia	Jan. 1	220,925,074	214,041,360	396,915,568	658,262,999	[b] 451,890,300
Trinidad and Tobago	Apr. 1	81,179,056	100,809,856	103,645,472	88,744,320	101,539,200
Other countries		948,358,615	1,093,894,758	1,033,443,798	985,775,000	[b] 1,007,483,000
Total		11,636,859,137	13,601,658,410	13,665,375,480	13,061,965,475	14,288,843,361

IMPORTS.

Country.	Year beginning—	1905.	1906.	1907.	1908.	1909.
Argentina	Jan. 1	330,327	4,085,229	95,781,273	91,654,477	43,683,538
Australia	Jan. 1	55,923,056	94,026,128	13,891,696	43,918,224	223,324,304
British India	Jan. 1	666,139,936	1,222,706,352	1,073,977,072	1,185,089,696	1,254,130,976
British South Africa [e]	Jan. 1	82,805,094	112,856,109	106,466,060	91,486,806	67,321,877
Canada	Jan. 1	388,668,153	461,635,652	444,983,523	437,085,696	522,558,227
Chile	Jan. 1	75,610,563	118,266,828	124,648,777	106,660,995	153,624,041
China	Jan. 1	626,433,333	872,765,600	782,549,467	578,563,200	743,704,800
Denmark	Jan. 1	76,080,072	45,254,827	53,083,219	82,653,042	84,324,407
Egypt	Jan. 1	86,880,895	76,321,099	54,872,620	117,407,689	108,403,341
Finland	Jan. 1	73,772,007	83,322,752	87,685,848	90,169,703	97,576,050
France	Jan. 1	179,460,755	222,562,321	238,168,985	254,266,538	238,557,561
Italy	Jan. 1	11,251,729	31,832,317	52,332,876	10,795,373	26,113,267
Japan	Jan. 1	289,129,733	504,816,933	439,518,000	443,138,800	298,867,600
Netherlands	Jan. 1	167,742,700	121,994,196	196,542,746	141,159,438	156,036,526
New Zealand	Jan. 1	89,439,230	93,329,376	118,135,248	102,663,680	116,441,136
Norway	Jan. 1	77,993,596	80,364,138	87,092,424	87,074,147	98,677,191
Persia	Mar. 21	154,217,415	209,477,168	191,423,247	187,302,229	201,246,499
Portugal	Jan. 1	70,011,389	72,092,109	72,965,925	73,321,464	77,187,757
Singapore	Jan. 1	117,958,267	134,471,066	102,563,467	91,263,733	125,336,667
Switzerland	Jan. 1	192,011,994	187,653,456	205,551,900	201,421,100	201,007,271
Turkey	Mar. 14	[f] 273,612,826	302,621,963	[d] 302,621,963	[g] 302,621,963	[g] 302,621,963
United Kingdom	Jan. 1	3,099,597,648	3,420,616,976	3,535,722,624	3,495,191,616	3,663,325,456
United States	Jan. 1	3,737,336,660	3,873,665,661	3,872,221,493	3,718,700,796	3,816,896,855
Uruguay	July 1	33,838,445	47,969,665	[b] 3,904,846	[d] 3,904,846	[h] 3,904,846
Other countries		583,891,511	438,510,189	531,965,044	595,478,000	[b] 618,985,000
Total		11,210,137,334	12,833,018,110	12,788,670,343	12,532,993,251	13,243,857,156

[a] See "General note," p. 507.
[b] Preliminary.
[c] Not including free ports prior to March 1, 1906.
[d] Year preceding.
[e] Cape Colony before 1906.
[f] Data for 1899.
[g] Data for 1906.
[h] Data for 1907.

SUGAR—Continued.

Sugar-beet acreage and beet-sugar production in the United States, 1901 to 1910.

[From reports of Department of Agriculture on Progress of the Beet-Sugar Industry in the United States.]

State and year.	Factories in operation.	Area harvested.	Average yield of beets per acre.	Beets worked.	Sugar manufactured.	Average extraction of sugar based on weight of beets.	Average sugar in beets.	Average purity coefficient of beets. [a]	Average length of campaign.
1910.		*Acres.*	*Tons.* [b]	*Tons.* [b]	*Pounds.*	*Per cent.*	*P. cent.*	*P. cent.*	*Days.*
California	10	83,000	10.63	882,084	254,544,000	14.43	17.61	83.62	102
Colorado	16	121,698	10.33	1,256,771	298,810,000	11.89	14.24	80.51	85
Idaho	3	15,434	10.60	163,557	39,988,000	12.22	15.98	86.17	83
Michigan	16	112,232	7.31	819,923	212,106,000	12.93	17.00	86.21	74
Utah	5	31,293	14.54	455,064	97,768,000	10.74	15.04	84.22	128
Wisconsin	4	14,000	10.21	143,000	34,340,000	12.01	15.88	85.17	63
States having but a single factory each: [c] Arizona, Illinois, Iowa, Kansas, Minnesota, Montana, Nebraska, New York, Ohio, Oregon, Washington	11	42,605	8.47	360,983	87,382,000	12.10	15.09	83.21	61
Totals and averages [d]	65	420,262	9.71	4,081,382	1,024,938,000	12.56	16.10	84.11	83
1909	65	420,262	9.71	4,081,382	1,024,938,000	12.56	16.10	84.11	83
1908	62	364,913	9.36	3,414,891	851,768,000	12.47	15.74	83.5	74
1907	63	370,984	10.16	3,767,871	927,256,430	12.30	15.8	83.6	89
1906	63	376,074	11.26	4,236,112	967,224,000	11.42	14.9	82.2	105
1905	52	307,364	8.67	2,665,913	625,841,228	11.74	15.3	83.0	77
1904	48	197,784	10.47	2,071,539	484,226,430	11.69	15.3	83.1	78
1903	49	242,576	8.56	2,076,494	481,209,087	11.59	[e] 15.1	([f])	75
1902	41	[g] 216,400	8.76	1,895,812	436,811,685	11.52	[e] 14.6	[e] 83.3	94
1901	36	175,083	9.63	1,685,689	369,211,733	10.95	14.8	82.2	88

[a] By purity coefficient is meant the percentage of sugar in the total solids of the substance tested, whether it be beets, juice, or sugar. In this table it represents the average percentage of sugar in the total solids of the beets as determined by tests made at the factories.

[b] Tons of 2,000 pounds each.

[c] Grouped together to avoid giving publicity to data relating to individual factories.

[d] The average yield of beets per acre is found by dividing the total beets worked by the total acreage harvested; the average extraction of sugar by dividing the total sugar produced by the total beets worked; the average contents of sugar, coefficients of purity, and length of campaign by adding the figures reported by the different factories and dividing by the number of reporting factories.

[e] These averages are not based on data for all the factories, as some of them failed to report results of tests, but it is believed that they fairly represent the character of the total beet crops.

[f] No data reported.

[g] Based on reports from 27 factories and careful estimates for 14 others.

TEA.

International trade in tea, 1905–1909.[a]

EXPORTS.

Country.	Year beginning—	1905.	1906.	1907.	1908.	1909.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
British India	Jan. 1	210,784,504	235,340,922	234,739,991	231,016,817	244,610,968
Ceylon	Jan. 1	170,183,558	170,527,126	179,843,462	179,398,312	192,886,545
China	Jan. 1	182,573,067	187,217,067	214,683,333	210,151,467	199,792,400
Dutch East Indies	Jan. 1	26,143,823	26,516,239	30,240,868	34,723,915	[b] 44,481,093
Formosa	Jan. 1	23,779,051	23,018,508	22,975,068	23,357,273	24,028,977
Japan	Jan. 1	38,565,730	39,636,497	40,589,420	35,269,765	40,664,949
Singapore	Jan. 1	2,411,600	2,396,667	2,521,333	2,266,400	2,257,333
Other countries	....	7,721,353	29,172,988	8,091,211	6,830,000	[b] 4,294,000
Total	....	662,162,686	713,826,014	733,684,686	723,013,949	753,016,265

IMPORTS.

Country.	Year beginning—	1905.	1906.	1907.	1908.	1909.
Argentina	Jan. 1	2,314,238	2,875,363	2,833,671	4,145,415	3,792,494
Australia	Jan. 1	28,353,903	29,478,614	35,174,152	29,873,772	31,617,111
Austria-Hungary	Jan. 1	2,755,998	2,859,615	3,090,439	3,104,320	3,183,442
British India	Jan. 1	6,669,868	5,426,731	5,965,738	7,598,559	6,786,653
British South Africa [c]	Jan. 1	3,254,298	4,823,363	4,613,177	4,613,065	4,364,868
Canada	Jan. 1	23,876,200	26,476,892	28,840,872	30,772,138	31,152,448
Chile	Jan. 1	2,496,479	2,904,127	2,380,893	2,320,521	2,832,664
Dutch East Indies	Jan. 1	4,962,110	5,113,929	5,443,220	5,740,269	[b] 5,906,565
France	Jan. 1	2,348,152	2,519,330	2,546,083	2,502,557	2,732,381
French Indo-China	Jan. 1	2,314,783	2,399,784	2,754,303	2,964,568	[b] 2,858,240
Germany [d]	Jan. 1	6,900,908	8,675,188	8,680,920	8,828,188	10,937,463
Netherlands	Jan. 1	9,090,607	9,559,206	9,202,811	10,234,107	10,299,052
New Zealand	Jan. 1	5,898,391	6,140,842	6,771,169	6,471,965	7,302,310
Persia	Mar. 21	6,997,776	5,410,358	9,782,414	7,477,782	8,127,241
Russia	Jan. 1	117,506,248	207,529,861	201,713,749	192,109,515	[b] 58,791,638
Singapore	Jan. 1	4,760,800	4,992,267	4,842,133	4,763,867	5,191,733
United Kingdom	Jan. 1	259,090,380	270,123,489	273,984,050	275,417,319	283,547,798
United States	Jan. 1	96,779,145	89,437,757	99,117,343	90,930,621	104,484,550
Other countries	....	32,326,198	32,070,924	44,263,232	40,958,000	[b] 43,638,000
Total	....	618,696,482	718,817,640	755,000,369	730,826,548	627,546,651

[a] See "General note," p. 507.
[b] Preliminary.
[c] Cape Colony before 1906.
[d] Not including free ports prior to March 1, 1906.

COFFEE.

Coffee crop of countries named, 1905–1909.

Countries.	1905	1906	1907	1908	1909
NORTH AMERICA.					
United States.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Porto Rico [a]	28,290,000	38,757,000	35,256,000	28,490,000	45,210,000
Hawaii [a]	2,311,000	1,230,000	1,442,000	1,963,000	2,702,000
Total [b]	30,601,000	39,987,000	36,698,000	30,453,000	47,912,000
Central America.					
Guatemala	68,856,000	90,059,000	89,232,000	82,134,000	81,120,000
Costa Rica [c]	39,788,000	30,367,000	38,200,000	19,797,000	26,522,000
Nicaragua	[c] 18,172,000	[c] 19,419,000	[d] 20,000,000	[d] 17,900,000	[d] 16,000,000
Salvador	65,710,000	57,425,000	56,320,000	[a] 57,589,000	[a] 63,330,000
Honduras	[e] 5,000,000	[e] 5,000,000	[e] 5,000,000	[e] 5,000,000	[d] 5,500,000
British Honduras [f]	13,000	12,000	10,000	10,000	([g])
Total	197,539,000	202,282,000	208,762,000	182,430,000	192,472,000
Mexico	88,479 000	86,961,000	[d] 45,000,000	[d] 42,000,000	[d] 81,000,000

[a] Exports, year beginning July 1.
[b] Not including Philippine Islands.
[c] Exports year ending December 31.
[d] Estimated.
[e] Estimated annual production 1904–1908.
[f] Partial returns.
[g] No data.

COFFEE—Continued.

Coffee crop of countries named, 1905-1909—Continued.

Countries.	1905.	1906.	1907.	1908.	1909.
CENTRAL AMERICA.					
West Indies.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Haiti	[a] 60,860,000	[a] 64,562,000	[a] 68,904,000	[a] 60,650,000	[b] 41,343,000
Santo Domingo [b]	2,149,000	2,917,000	3,411,000	4,081,000	1,542,000
Trinidad [c]	13,000	19,000	9,000	4,000	4,000
Jamaica [c]	9,046,000	6,144,000	10,551,000	7,885,000	8,254,000
Guadeloupe [d]	1,903,000	1,903,000	1,903,000	1,903,000	1,903,000
Cuba	(f)	(f)	6,596,000	(f)	(f)
Leeward Islands (British) [b]	2,000	1,000	3,000	5,000	2,000
Total	73,973,000	75,546,000	91,377,000	74,528,000	53,048,000
Total North America	390,592,000	404,776,000	381,837,000	329,411,000	374,432,000
SOUTH AMERICA.					
Brazil: [b]					
Rio de Janeiro	366,830,000	422,435,000	466,395,000	405,069,000	392,574,000
Santos	985,962,000	1,344,765,000	1,517,236,000	1,182,579,000	1,779,523,000
Victoria	50,401,000	47,140,000	60,973,000	62,885,000	39,616,000
Bahia	24,256,000	29,293,000	27,016,000	21,894,000	19,620,000
Other ports	3,878,000	3,725,000	2,511,000	2,001,000	1,578,000
Total	1,431,327,000	1,847,358,000	2,074,131,000	1,674,428,000	2,232,911,000
Venezuela [g]	94,370,000	99,201,000	90,190,000	103,454,000	93,987,000
Colombia [d]	79,366,000	79,366,000	79,366,000	79,366,000	79,366,000
Bolivia [d]	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000
Ecuador [b]	4,863,000	5,835,000	2,520,000	8,315,000	7,550,000
Peru [b]	1,839,000	2,469,000	2,443,000	1,102,000	1,102,000
Dutch Guiana	594,000	481,000	522,000	457,000	554,000
British Guiana	(e)	(e)	(e)	89,000	97,000
Total South America	1,613,859,000	2,036,210,000	2,250,672,000	1,868,711,000	2,417,067,000
ASIA.					
Dutch East Indies.					
Java [h]	59,092,000	66,853,000	31,044,000	39,349,000	[d] 52,010,000
Sumatra [h]	10,348,000	4,085,000	5,719,000	9,586,000	[d] 7,173,000
Celebes [d]	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000
Total [h]	71,440,000	72,938,000	38,763,000	50,935,000	61,183,000
Federated Malay States: [b]					
Perak	62,000	133,000	26,000	2,000	1,000
Selangor	4,310,000	3,695,000	2,281,000	2,334,000	1,757,000
Negri Sembilan	446,000	522,000	259,000	94,000	43,000
British India [h]	31,179,000	17,695,000	33,051,000	[c] 33,826,000	27,648,000
Ceylon	1,008,000	750,000	420,000	310,000	[d] 685,000
British North Borneo [b]	41,000	12,000	3,000	4,000	3,000
Sarawak [b]	37,000	38,000	26,000	22,000	17,000
Arabia (Aden) [c]	12,838,000	12,813,000	14,370,000	15,669,000	15,669,000
Total Asia	121,361,000	108,596,000	89,199,000	103,196,000	107,006,000
AFRICA.					
Somaliland [c]	5,000	330,000	198,000	245,000	245,000
Southern Nigeria [b]	88,000	69,000	39,000	37,000	70,000
Nyasaland Protectorate	636,000	506,000	885,000	1,011,000	774,000
German East Africa [b]	884,000	1,105,000	1,393,000	1,878,000	1,878,000
Somali Coast [b]	5,793,000	5,047,000	7,257,000	5,767,000	5,767,000
Liberia [d]	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000
Abyssinia [d]	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000
Uganda Protectorate [c]	34,000	12,000	13,000	22,000	33,000
Sierra Leone	10,000	23,000	16,000	21,000	21,000
Union of South Africa:					
Natal	9,000	31,000	28,000	19,000	4,000
Seychelles [b]	(e)	6,000	7,000	6,000	2,000
Gold Coast [b]	5,000	3,000	1,000	(e)	(e)
Belgian Kongo [b]	238,000	165,000	161,000	91,000	28,000
Total Africa	19,702,000	19,297,000	21,998,000	21,097,000	20,822,000
OCEANIA.					
New Caledonia [b]	651,000	626,000	721,000	783,000	783,000
Queensland	82,000	107,000	112,000	116,000	89,000
Papua [b]	6,000	48,000	39,000	27,000	13,000
Total Oceania	739,000	781,000	872,000	926,000	885,000
Grand total	2,146,253,000	2,569,660,000	2,744,578,000	2,323,341,000	2,920,212,000

[a] Exports year beginning October 1.
[b] Exports year ending December 31.
[c] Exports year ending March 31 of the year following that stated.
[d] Estimated annual production 1904-1908.
[e] Less than 1,000 pounds.
[f] No data.
[g] Exports, year beginning July 1.
[h] Partial returns.

COFFEE—Continued.

International trade in coffee, 1905–1909.[a]

EXPORTS.

Country.	Year beginning—	1905.	1906.	1907.	1908.	1909.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Brazil	Jan. 1	1,431,343,492	1,847,367,771	2,074,171,256	1,674,432,552	2,232,910,944
British India	Jan. 1	41,138,720	36,584,688	17,866,128	37,568,832	23,625,504
Colombia [b]	Jan. 1	67,248,000	70,000,000	70,000,000	70,000,000	70,000,000
Costa Rica	Jan. 1	39,788,002	30,367,032	38,199,587	19,797,312	26,521,567
Dutch East Indies	Jan. 1	72,864,649	75,761,218	55,998,249	56,806,209	[c] 39,054,808
Guatemala	Jan. 1	82,241,067	69,289,369	99,740,180	63,333,526	[d] 63,333,526
Haiti	Oct. 1	60,860,372	64,561,503	68,903,525	[c] 41,000,000	[d] 41,000,000
Jamaica	Apr. 1	9,046,464	6,144,432	10,551,184	7,885,248	8,253,616
Mexico	Jan. 1	47,182,496	37,568,983	29,980,000	52,591,066	54,874,939
Netherlands	Jan. 1	148,744,186	161,617,580	177,012,048	179,444,917	193,098,597
Nicaragua	Jan. 1	18,171,515	19,418,928	[c] 20,000,000	[c] 17,900,000	[d] 17,900,000
Salvador	July 1	64,480,526	68,952,128	58,751,356	57,589,360	[c] 63,330,000
Singapore	Jan. 1	7,813,067	7,860,533	6,314,400	6,765,200	5,488,267
United States	Jan. 1	21,777,960	32,821,342	41,802,527	34,268,012	35,089,526
Venezuela	July 1	94,370,089	99,200,810	90,189,684	103,453,539	93,987,140
Other countries		79,006,551	60,085,421	74,064,719	88,849,000	[c] 78,533,000
Total		2,286,077,156	2,687,601,738	2,933,544,843	2,511,684,773	3,047,001,434

IMPORTS.

Country.	Year beginning—	1905.	1906.	1907.	1908.	1909.
Argentina	Jan. 1	18,516,812	20,229,490	21,625,655	22,085,972	25,548,267
Austria-Hungary	Jan. 1	107,106,048	112,841,372	131,930,753	121,780,012	126,991,574
Belgium	Jan. 1	100,032,285	119,040,964	250,282,012	134,658,074	126,319,127
British South Africa [e]	Jan. 1	21,136,170	26,862,060	23,686,674	25,321,709	27,727,936
Cuba	Jan. 1	23,916,707	21,357,127	23,250,910	24,432,111	25,407,861
Denmark	Jan. 1	21,220,589	23,148,531	23,477,020	24,017,703	33,020,499
Egypt	Jan. 1	13,996,858	18,401,914	14,976,566	21,146,287	18,994,922
Finland	Jan. 1	25,743,433	29,085,091	29,007,779	28,549,443	30,191,968
France	Jan. 1	200,594,621	215,713,162	223,932,282	226,559,741	237,975,547
Germany [f]	Jan. 1	398,491,379	411,815,012	418,373,762	425,332,652	470,923,724
Italy	Jan. 1	41,287,279	45,046,159	47,356,824	50,189,763	53,121,381
Netherlands	Jan. 1	206,246,193	255,731,280	259,830,047	262,479,471	288,284,852
Norway	Jan. 1	25,311,450	28,250,644	28,838,572	27,186,340	32,291,526
Russia	Jan. 1	21,691,262	23,584,331	25,067,520	25,691,765	[c] 25,925,379
Singapore	Jan. 1	7,784,667	8,524,000	7,397,600	7,405,067	6,632,133
Spain	Jan. 1	24,084,186	28,518,089	24,895,066	27,373,358	27,070,627
Sweden	Jan. 1	66,417,080	77,507,951	71,240,034	66,899,643	92,267,883
Switzerland	Jan. 1	20,958,680	24,885,994	25,202,136	24,436,471	26,515,606
United Kingdom	Jan. 1	28,852,729	28,640,738	29,242,982	29,195,788	29,677,088
United States	Jan. 1	893,889,352	857,013,585	940,247,312	938,559,889	1,139,826,171
Other countries		80,777,562	78,324,516	95,070,607	98,942,000	[c] 97,714,000
Total		2,348,055,342	2,454,522,010	2,714,932,113	2,612,243,259	2,942,428,071

[a] See "General note," p. 507.
[b] Estimated except for 1905.
[c] Preliminary.
[d] Year preceding.
[e] Cape Colony before 1906.
[f] Not including free ports prior to March 1, 1906.

OIL CAKE AND OIL-CAKE MEAL.

International trade in oil cake and oil-cake meal, 1905–1909.[a]

EXPORTS.

Country.	Year beginning—	1905.	1906.	1907.	1908.	1909.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Argentina	Jan. 1	29,277,380	29,524,298	26,703,310	31,866,797	36,751,081
Austria-Hungary	Jan. 1	77,134,433	78,843,897	93,136,461	113,952,281	115,295,289
Belgium	Jan. 1	160,163,061	176,470,002	146,626,113	149,098,934	153,062,212
British India	Jan. 1	180,575,696	105,207,200	127,575,168	158,531,296	164,075,296
Canada	Jan. 1	9,190,800	34,803,800	44,286,700	41,743,700	42,774,000
China	Jan. 1	95,344,667	120,944,400	132,974,800	129,166,933	140,888,933
Denmark	Jan. 1	5,676,571	3,101,969	4,889,005	2,757,541	9,378,148
Egypt	Jan. 1	147,961,001	164,142,926	145,538,121	148,649,000	166,676,578
France	Jan. 1	339,529,396	323,482,202	312,335,633	329,693,063	410,340,434
Germany [c]	Jan. 1	397,800,450	361,592,621	396,195,045	414,855,627	431,040,085
Italy	Jan. 1	24,425,228	12,617,052	16,901,514	47,744,617	51,145,397
Netherlands	Jan. 1	143,290,470	147,620,993	206,333,847	156,919,410	158,760,889
Russia	Jan. 1	977,376,790	1,155,869,540	1,164,122,145	1,460,057,008	[b]1,373,044,769
United Kingdom	Jan. 1	57,830,080	58,524,480	49,669,760	36,910,720	247,452,800
United States	Jan. 1	1,861,577,352	1,929,901,354	1,959,101,228	1,959,213,339	1,488,233,547
Other countries	....	100,683,961	124,546,370	128,143,233	128,897,000	[b]103,228,000
Total	....	4,607,837,336	4,827,193,104	4,954,532,083	5,310,057,266	5,092,147,458

IMPORTS.

Country.	Year beginning—	1905.	1906.	1907.	1908.	1909.
Austria-Hungary	Jan. 1	26,469,794	24,769,590	36,386,625	27,152,565	37,056,460
Belgium	Jan. 1	448,216,564	510,213,668	423,941,798	553,066,958	534,676,433
Canada	Jan. 1	3,606,600	1,889,700	4,290,000	3,741,000	5,024,200
Denmark	Jan. 1	842,875,492	843,140,047	947,748,259	1,036,950,572	1,046,131,201
Dutch East Indies	Jan. 1	19,075,498	26,850,775	21,089,491	14,133,754	[d]14,133,754
Finland	Jan. 1	11,179,475	14,543,404	23,857,077	20,873,178	22,013,822
France	Jan. 1	323,719,234	237,725,713	247,780,333	200,278,445	273,874,372
Germany [c]	Jan. 1	1,285,529,859	1,325,622,674	1,573,607,155	1,463,999,742	1,612,275,568
Italy	Jan. 1	5,209,963	7,851,541	10,577,997	10,834,835	13,299,690
Japan	Jan. 1	110,074,533	134,060,451	162,850,133	139,939,333	125,114,400
Netherlands	Jan. 1	510,951,427	564,097,473	639,972,913	701,182,543	627,553,310
Sweden	Jan. 1	226,374,498	264,890,580	317,805,100	258,508,025	316,504,552
United Kingdom	Jan. 1	797,368,320	797,115,200	731,057,600	736,330,560	730,833,600
Other countries	....	153,440,166	143,088,371	157,950,252	161,473,000	[b]165,704,000
Total	....	4,764,091,423	4,895,859,187	5,298,914,733	5,328,464,510	5,524,195,362

[a] See "General note," p. 507.
[b] Preliminary.
[c] Not including free ports prior to March 1, 1906.
[d] Year preceding.

ROSIN.

International trade in rosin, 1905–1909.[a]

EXPORTS.

Country.	Year beginning—	1905.	1906.	1907.	1908.	1909.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Austria-Hungary	Jan. 1	3,372,410	3,154,594	3,019,450	2,631,878	2,292,784
Germany [b]	Jan. 1	46,370,255	46,088,946	55,019,208	60,958,460	48,019,054
Netherlands	Jan. 1	58,544,509	79,550,046	76,673,653	86,768,631	56,629,686
United States	Jan. 1	632,275,280	694,755,320	738,121,720	728,330,680	555,667,000
Other countries	....	675,870	18,210,324	42,505,829	61,197,000	[c] 45,953,000
Total	....	741,238,324	841,759,230	915,339,860	939,886,649	708,561,524

IMPORTS.

Country.	Year beginning—	1905.	1906.	1907.	1908.	1909.
Argentina	Jan. 1	20,409,438	22,957,066	23,206,173	23,529,126	28,100,579
Australia	Jan. 1	14,037,408	10,326,800	15,618,176	18,015,312	9,041,200
Austria-Hungary	Jan. 1	62,482,294	73,355,049	74,316,926	82,325,113	70,230,179
Brazil	Jan. 1	27,492,124	21,608,739	26,829,551	34,134,001	[d] 34,134,001
Canada	Jan. 1	18,907,000	19,167,200	21,856,300	17,004,000	22,967,200
Chile	Jan. 1	2,108,756	3,536,588	3,173,882	2,112,888	3,413,356
Cuba	Jan. 1	1,760,478	1,536,070	3,709,909	2,520,339	2,848,506
Denmark	Jan. 1	2,033,764	2,326,979	2,439,414	2,382,094	3,044,553
Finland	Jan. 1	5,133,632	3,893,252	7,509,485	7,058,536	4,370,282
Germany [b]	Jan. 1	208,295,553	235,300,629	247,632,623	286,217,917	216,806,316
Italy	Jan. 1	27,539,477	32,796,618	33,591,825	38,811,048	23,571,583
Japan	Jan. 1	6,378,787	6,599,144	7,120,409	8,035,293	4,738,545
Netherlands	Jan. 1	78,666,949	80,488,983	90,920,593	98,809,593	63,619,681
Russia	Jan. 1	59,632,597	60,581,028	67,762,383	75,526,599	55,750,941
Servia	Jan. 1	7,894,169	1,371,797	4,562,763	473,546	3,643,860
Spain	Jan. 1	3,684,871	4,696,182	5,633,969	2,907,176	3,218,374
Sweden	Jan. 1	11,443,057	13,110,667	12,885,520	14,050,543	7,977,111
Switzerland	Jan. 1	5,736,867	5,306,746	5,271,031	4,626,620	4,469,386
United Kingdom	Jan. 1	177,010,624	174,996,752	177,534,336	171,698,688	148,453,648
Uruguay	July 1	4,881,232	[e] 4,881,232	[c] 682,304	[d] 682,304	[f] 682,304
Other countries	....	13,005,454	27,285,931	22,195,464	25,079,000	[c] 27,818,000
Total	....	758,534,531	806,123,452	854,453,036	915,999,736	738,899,605

[a] See "General note," p. 507.
[b] Not including free ports prior to March 1, 1906.
[c] Preliminary.
[d] Year preceding.
[e] Data for 1905.
[f] Data for 1907.

TURPENTINE.

International trade in spirits of turpentine, 1905–1909.[a]

EXPORTS.

Country.	Year beginning—	1905.	1906.	1907.	1908.	1909.
		Gallons.	*Gallons.*	*Gallons.*	*Gallons.*	*Gallons.*
France	Jan. 1	3,179,105	3,367,371	2,538,714	2,397,710	2,400,228
Germany[b]	Jan. 1	520,750	460,735	349,555	433,239	380,385
Netherlands	Jan. 1	972,714	1,400,645	1,675,788	1,851,937	1,770,823
Russia	Jan. 1	2,504,423	1,804,858	1,831,320	1,773,655	[c] 2,332,285
United States	Jan. 1	15,614,323	16,182,500	17,176,843	19,433,181	16,061,783
Other countries		89,867	105,869	1,002,284	1,357,000	[c] 1,486,000
Total		22,881,182	23,321,978	24,574,504	27,246,722	24,431,504

IMPORTS.

Country.	Year beginning—	1905.	1906.	1907.	1908.	1909.
Argentina	Jan. 1	290,804	570,426	521,857	446,967	411,290
Australia	Jan. 1	291,809	377,650	522,656	395,430	347,110
Austria-Hungary	Jan. 1	2,021,485	2,218,095	2,291,153	2,409,713	2,439,635
Canada	Jan. 1	789,886	842,525	1,028,936	1,081,181	1,141,228
Chile	Jan. 1	136,124	173,918	207,237	118,542	155,113
Germany[b]	Jan. 1	8,539,910	9,966,790	8,986,101	10,088,871	9,764,051
Italy	Jan. 1	687,291	948,171	921,287	1,020,128	824,643
Netherlands	Jan. 1	2,248,055	2,711,797	3,036,027	3,932,356	2,721,839
New Zealand	Jan. 1	153,999	158,399	145,808	138,807	96,208
Russia	Jan. 1	192,902	314,342	333,482	238,671	[c] 205,642
Sweden	Jan. 1	115,383	141,077	146,202	148,913	126,289
Switzerland	Jan. 1	346,279	462,297	40,482	503,879	412,046
United Kingdom	Jan. 1	7,693,933	7,673,758	7,515,293	8,656,464	6,522,833
Other countries		711,974	1,884,017	982,536	956,000	[c] 807,000
Total		24,219,834	28,443,262	26,679,057	30,135,922	25,974,927

[a] See "General note," p. 507. [b] Not including free ports prior to March 1, 1906. [c] Preliminary.

INDIA RUBBER.

International trade in india rubber, 1905–1909.[a]

EXPORTS.

Country.	Year beginning—	1905.	1906.	1907.	1908.	1909.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Angola	Jan. 1	[b] 5,200,000	[b] 5,200,000	[b] 5,200,000	[b] 5,200,000	[b] 5,200,000
Belgian Kongo	Jan. 1	10,718,358	10,690,060	10,266,314	10,052,913	8,268,606
Belgium	Jan. 1	14,997,420	16,940,908	13,886,021	15,036,638	16,168,832
Bolivia	Jan. 1	3,728,726	4,254,058	4,035,589	4,008,415	6,729,438
Brazil	Jan. 1	78,027,329	77,073,991	80,446,154	84,230,498	[c] 86,038,347
Dutch East Indies	Jan. 1	4,569,275	4,564,932	14,068,081	6,719,897	[c] 7,016,869
Ecuador	Jan. 1	1,293,134	1,394,575	1,033,670	887,085	1,133,782
France	Jan. 1	10,766,377	13,033,578	12,751,379	13,045,487	15,993,271
French Guinea	Jan. 1	3,121,366	3,374,026	2,864,282	2,878,698	[d] 2,878,698
French Kongo	Jan. 1	3,716,860	4,310,082	4,061,352	3,378,585	[d] 3,378,585
Germany [e]	Jan. 1	18,654,850	19,887,013	10,500,394	9,099,798	8,964,345
Gold Coast	Jan. 1	3,687,778	3,649,668	3,549,548	1,773,248	2,764,190
Ivory Coast	Jan. 1	2,602,638	3,347,895	3,024,783	2,018,644	2,744,456
Kamerun	Jan. 1	2,141,777	2,537,540	3,291,084	5,289,408	[d] 5,289,408
Netherlands	Jan. 1	5,760,814	5,605,388	4,121,106	3,774,042	3,952,718
Peru	Jan. 1	5,598,785	5,678,357	6,677,097	[c] 6,677,097	[f] 6,677,097
Senegal	Jan. 1	2,242,786	2,618,511	2,293,164	1,279,587	[d] 1,279,587
Singapore	Jan. 1	5,053,067	5,888,000	5,422,133	4,875,067	5,544,267
Southern Nigeria	Jan. 1	2,842,831	3,434,279	2,843,823	1,222,203	1,388,009
Venezuela	July 1	219,693	369,100	426,123	751,659	[c] 700,357
Other countries		11,714,817	18,266,180	25,194,477	24,085,000	[c] 30,711,000
Total		196,658,681	212,118,141	215,956,574	206,283,969	222,821,862

IMPORTS.

Country.	Year beginning—	1905.	1906.	1907.	1908.	1909.
Austria-Hungary	Jan. 1	3,021,875	4,231,331	4,967,454	4,237,504	4,744,740
Belgium	Jan. 1	18,744,212	20,813,089	18,292,494	17,783,480	18,854,099
Canada	Jan. 1	2,504,217	2,542,580	2,777,668	1,868,569	2,759,751
France	Jan. 1	19,693,018	23,053,199	24,111,907	22,097,539	25,579,092
Germany [e]	Jan. 1	47,627,110	51,488,947	34,851,767	32,498,112	34,208,999
Italy	Jan. 1	1,690,725	2,586,242	2,241,660	3,298,996	3,455,490
Netherlands	Jan. 1	6,645,498	8,189,950	8,142,875	6,522,685	6,364,301
Russia	Jan. 1	12,913,540	16,702,892	15,036,756	16,683,536	[c] 15,817,406
United Kingdom	Jan. 1	29,000,832	31,004,400	35,646,016	24,253,600	33,839,456
United States	Jan. 1	64,147,701	67,907,251	68,653,291	76,289,474	93,967,414
Other countries		9,278,344	11,639,538	11,271,855	11,082,000	[c] 12,899,000
Total		215,267,072	240,159,419	225,993,743	216,615,495	252,489,748

[a] See "General note," p. 507.
[b] Estimated.
[c] Preliminary.
[d] Year preceding.
[e] Not including free ports prior to March 1, 1906.
[f] Data for 1907.

SILK.

Raw silk production of countries named, 1905–1910.

[Estimate of the Silk Manufacturers' Association of Lyon, France.]

Country.	1905.	1906.	1907.	1908.	1909.[a]
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Western Europe:					
Italy	9,788,000	10,461,000	10,626,000	9,890,000	9,372,000
France	1,393,000	1,333,000	1,459,000	1,446,000	1,486,000
Spain	172,000	124,000	181,000	166,000	176,000
Austria-Hungary	761,000	754,000	761,000	736,000	838,000
Total	12,114,000	12,672,000	13,027,000	12,238,000	11,872,000
Levant and Central Asia:					
Anatolia	1,424,000	1,221,000	1,327,000	1,356,000	2,767,000
Syria and Cyprus	1,080,000	1,037,000	1,179,000	1,080,000	
Other provinces of Asiatic Turkey	....	....	322,000	320,000	
Salonica and Adrianople	617,000	567,000	754,000	628,000	694,000
Balkan States	419,000	408,000	496,000	456,000	694,000
Greece and Crete	155,000	165,000	168,000	143,000	154,000
Caucasus	640,000	1,003,000	1,085,000	794,000	1,191,000
Persia and Turkestan (exports)	1,014,000	1,385,000	1,340,000	1,160,000	1,323,000
Total	5,349,000	5,786,000	6,671,000	5,937,000	6,823,000
Far East:					
China—					
Exports from Shanghai	8,841,000	9,396,000	9,160,000	12,430,000	11,243,000
Exports from Canton	4,409,000	4,325,000	4,960,000	5,242,000	4,817,000
Japan—					
Exports from Yokohama	10,183,000	13,210,000	14,044,000	16,689,000	18,078,000
British India—					
Exports from Calcutta and Bombay	617,000	717,000	772,000	551,000	518,000
Total	24,050,000	27,648,000	28,936,000	34,912,000	34,656,000
Grand total	41,513,000	46,106,000	48,634,000	53,087,000	53,351,000

a Preliminary.

WOOD PULP.

International trade in wood pulp, 1905–1909.[a]

EXPORTS.

Country.	Year beginning—	1905.	1906.	1907.	1908.	1909.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Austria-Hungary	Jan. 1	166,589,396	170,770,020	187,836,660	177,784,025	173,668,467
Belgium	Jan. 1	54,872,925	68,233,066	72,943,332	54,463,780	59,705,365
Canada[b]	Jan. 1	349,000,000	397,000,000	483,000,000	480,000,000	629,000,000
Finland	Jan. 1	133,477,320	123,858,426	133,410,176	140,860,769	157,561,012
Germany[c]	Jan. 1	153,651,351	156,740,026	211,885,779	281,362,458	319,289,793
Norway	Jan. 1	975,158,500	1,114,716,540	1,227,103,672	1,310,902,325	1,326,893,206
Sweden	Jan. 1	846,213,535	914,501,238	1,170,316,873	1,242,850,222	1,242,456,239
Switzerland	Jan. 1	14,004,420	13,901,905	13,066,133	12,338,167	11,168,724
United States	Jan. 1	26,379,946	28,267,309	24,839,012	22,595,379	17,905,481
Other countries	....	49,843,083	79,751,207	75,160,286	56,826,000	[d]74,117,000
Total	....	2,769,190,476	3,067,739,737	3,599,561,923	3,779,983,125	4,011,765,287

IMPORTS.

Country.	Year beginning—	1905.	1906.	1907.	1908.	1909.
Argentina	Jan. 1	30,886,404	37,368,826	40,845,920	39,930,837	33,847,259
Austria-Hungary	Jan. 1	4,702,018	4,050,552	4,304,084	5,601,724	7,675,094
Belgium	Jan. 1	174,530,060	228,929,053	243,156,228	265,428,111	258,171,760
Denmark	Jan. 1	67,310,417	64,300,231	80,113,097	75,010,059	100,035,930
France	Jan. 1	490,998,886	563,826,785	630,970,533	692,701,492	640,890,227
Germany[c]	Jan. 1	109,748,067	103,547,347	116,995,542	99,261,783	90,295,125
Italy	Jan. 1	93,789,911	114,677,382	126,906,861	135,943,606	145,528,953
Japan	Jan. 1	22,769,993	37,020,666	35,476,759	40,753,602	38,311,700
Russia	Jan. 1	44,467,063	46,715,121	45,479,955	49,052,161	[d]49,897,056
Spain	Jan. 1	70,535,843	76,781,583	82,575,953	79,954,210	69,243,596
Sweden	Jan. 1	6,579,205	7,882,006	6,691,936	6,448,409	6,685,152
Switzerland	Jan. 1	19,680,440	16,764,828	19,232,681	20,914,147	19,705,376
United Kingdom	Jan. 1	1,280,780,480	1,341,735,360	1,484,703,360	1,662,662,400	1,661,959,040
United States	Jan. 1	341,734,400	399,403,200	593,555,200	500,969,689	735,300,119
Other countries	Jan. 1	122,801,943	118,569,048	25,424,495	25,366,000	[d]30,144,000
Total	....	2,881,315,130	3,161,571,988	3,536,432,604	3,699,998,230	3,887,690,387

[a] See "General note," p. 507.
[b] Estimated from value.
[c] Not including free ports prior to March 1, 1906.
[d] Preliminary.

FARM ANIMALS AND THEIR PRODUCTS.

Live stock of countries named.

[Africa incompletely represented, through lack of statistics for large areas. Number of animals in China, Persia, Afghanistan, Korea, Bolivia, Ecuador, and several less important countries unknown. For Brazil number of cattle alone estimated, but roughly. In general, statistics of cattle, horses, sheep, and swine much more complete than those of other animals, as statements for the world.]

Country.	Year.	Cattle.		Horses.	Mules.	Sheep.	Swine.
		Total.	Dairy cows.				
NORTH AMERICA.							
United States:							
Contiguous—							
On farms	1910	69,080,000	21,801,000	21,040,000	4,123,000	57,216,000	47,782,000
Not on farms	1900	1,616,422	973,033	2,936,881	173,908	231,301	1,818,114
Noncontiguous—							
Alaska [a]	1900	18	13	5	...	...	10
Hawaii [a]	1900	102,908	4,028	12,982	6,506	102,098	8,057
Porto Rico	1899	260,225	73,372	58,664	6,985	6,363	66,180
Total United States (except Philippine Islands)	...	71,059,573	22,851,446	24,048,532	4,310,399	57,555,762	49,674,361
Bermuda	1908	1,516	...	[b] 1,082	...	...	...
Canada:							
Prince Edward Island	1910	113,013	55,365	34,121	...	110,599	48,623
Nova Scotia	1910	329,137	148,948	68,721	...	358,263	69,958
New Brunswick	1910	232,525	122,136	66,855	...	203,620	91,250
Quebec	1910	1,456,428	856,151	368,419	...	549,068	651,415
Ontario	1910	2,873,044	1,243,680	802,949	...	1,032,227	1,481,058
Manitoba	1910	479,741	164,746	244,987	...	30,266	142,312
Saskatchewan	1910	569,619	138,455	332,922	...	135,360	125,788
Alberta	1910	1,051,407	124,470	294,225	...	179,067	143,560
British Columbia	1901	125,002	24,535	37,325	...	33,350	41,419
Total Canada	...	7,229,916	2,878,486	2,250,524	...	2,631,820	2,795,383
Central America:							
Costa Rica	1907	373,630	[c] 95,462	63,651	4,831	187	111,316
Guatemala	1898	196,768	...	50,343	...	77,593	29,784
Honduras	1909	666,215	...	64,122	13,434	24,052	145,352
Nicaragua	1908	252,070	...	28,276	6,078	338	11,591
Panama	1907	65,000	...	17,000	1,500	...	28,000
Salvador	1908	284,013	...	74,336	...	21,457	422,980
Mexico	1902	5,142,457	...	859,217	334,435	3,424,430	616,139
Newfoundland	1901	32,767	...	8,851	...	78,052	34,679
West Indies:							
British—							
Bahamas	1909	1,680	...	991	...	12,881	...
Barbados	1909	...	...	2,410	3,793	...	...
Dominica	1909	1,437	...	607	...	1,088	...
Grenada	1901	1,908	...	1,074	...	1,975	...
Jamaica	1909	111,006	...	53,179	...	12,849	31,200
Montserrat	1909	...	...	260	...	...	...
Trinidad and Tobago	1909	10,426	...	4,288	...	2,360	9,129
Turks and Caicos Islands	1909	700	...	100	...	200	...
Virgin Islands	1909	2,000	...	232	...	300	...
Cuba	1910	3,074,509	...	555,423	58,957	[d] 9,982	[d] 358,868
Dutch West Indies	1908	3,205	...	697	154	20,155	4,788
Guadeloupe	([e])	30,560	...	8,819	6,311	11,731	32,656
Total	...	88,541,356	...	28,094,014	4,739,892	63,887,212	54,306,226
SOUTH AMERICA.							
Argentina	1908	29,116,625	...	7,531,376	465,037	67,211,754	1,403,591
Brazil	...	25,000,000	...	...	...	...	...
British Guiana	1909	72,000	...	1,650	...	18,000	13,000
Chile	1908	2,303,659	205,084	516,764	[f] 83,092	4,224,266	216,360
Colombia	...	2,800,000	...	341,000	257,000	746,000	2,300,000

[a] On farms.
[b] Including mules and asses.
[c] Cows.
[d] Census for 1899.
[e] Official estimate furnished by the French Embassy to the United States under date of May 4, 1906.
[f] Including asses.

Live stock of countries named—Continued.

Country.	Year.	Cattle.		Horses.	Mules.	Sheep.	Swine.
		Total.	Dairy cows.				
SOUTH AMERICA—contd.							
Dutch Guiana	1908	7,445	....	265	114	113	2,923
Falkland Islands	1908	5,382	....	3,314	....	[a] 715,651	72
Paraguay [b]	1908	5,500,000	....	182,790	7,626	214,060	23,900
Uruguay	1908	8,192,602	....	556,307	17,671	26,286,296	180,099
Venezuela	1899	2,004,257	....	191,079	89,186	176,668	1,618,214
Total	....	75,001,970	....	9,324,545	919,726	99,592,808	5,758,159
EUROPE.							
Austria-Hungary:							
Austria	1900	9,511,170	[c] 4,749,152	1,716,488	20,323	2,621,026	4,682,654
Hungary	1908	7,152,568	....	2,173,648	[d] 1,911	7,904,634	5,489,946
Bosnia-Herzegovina	1895	[e] 1,417,341	....	[f] 239,626	....	3,230,720	662,242
Total Austria-Hungary	....	18,081,079	....	4,129,762	22,234	13,756,380	10,834,842
Belgium	[g] 1909	1,861,412	[h] 912,781	253,431	[d, i] 6,915	[d] 235,722	1,161,761
Bulgaria	1906	1,695,533	[c] 493,451	538,271	11,947	8,130,997	465,333
Denmark	1909	2,243,889	[c] 1,282,254	534,680	....	726,027	1,466,932
Faroe Islands	1909	4,093	....	615	....	99,900	58
Finland	1907	1,491,264	[c] 1,113,633	327,817	....	904,447	221,072
France	[g] 1909	14,239,730	[c] 7,520,750	3,215,050	194,010	17,456,380	7,202,430
Germany	1907	20,630,544	10,222,792	4,345,047	942	7,703,710	22,146,532
Gibraltar	1909	349	....	279	....	....	....
Greece	1902	406,744	....	159,068	88,869	4,568,158	79,716
Iceland	1908	23,413	....	45,121	....	512,418	....
Italy	1908	6,195,966	....	955,566	388,331	11,162,768	2,506,970
Luxemburg	1907	103,485	58,449	18,847	....	8,467	134,067
Malta	1910	6,570	....	9,762	3,266	17,485	4,184
Montenegro	....	60,000	[c] 20,000	3,000	....	400,000	8,000
Netherlands	1904	1,690,463	[j] 973,098	295,277	....	606,785	861,840
Norway	[g] 1908	1,094,101	[c] 727,898	172,468	....	1,393,488	318,556
Portugal	1906	703,198	....	87,765	57,647	3,072,988	1,110,957
Roumania	1900	2,545,051	380,720	864,324	515	5,655,444	1,709,205
Russia:							
Russia proper	1908	30,800,826	....	20,934,415	....	[k] 38,048,736	9,953,973
Poland	1908	2,377,285	....	1,280,410	....	[k] 1,339,274	746,352
Northern Caucasia	1908	2,876,437	....	1,358,193	....	[k] 6,452,351	781,700
Total Russia, European	1908	36,054,548	....	23,573,018	....	[k] 45,840,361	11,482,025
Servia	1905	969,953	[l] 153,359	174,363	739	3,160,166	908,108
Spain	1909	2,317,478	....	494,853	864,555	15,471,183	2,296,011
Sweden	1909	2,685,020	[c] 1,838,770	574,872	....	1,010,217	894,670
Switzerland	1906	1,498,144	[c] 785,950	135,372	3,153	209,997	548,970
Turkey	....	1,000,000	[c] 300,000	600,000	....	10,000,000	....
United Kingdom:							
Great Britain	1910	7,037,298	[m] 2,767,606	[n] 1,545,287	....	27,101,140	2,349,897
Ireland	1910	4,688,888	[m] 1,557,584	[n] 613,244	31,460	3,979,516	1,200,005
Isle of Man and Channel Islands	1908	41,200	[m] 18,160	[n] 9,670	....	86,564	14,471
Total United Kingdom	....	11,767,386	4,343,350	2,168,201	31,460	31,167,220	3,564,373
Total	....	129,369,413	....	43,676,829	1,674,583	183,270,708	69,926,612
ASIA.							
British India:							
British Provinces	1909	[o] 99,560,604	30,637,393	1,557,806	103,794	20,189,949	....
Native States [p]	1908	[o] 8,817,386	3,008,370	109,286	....	[q] 3,855,677	....
Total British India	....	108,377,990	33,645,763	1,667,092	103,794	24,045,626	....

[a] Data for 1909.
[b] Unofficial estimate.
[c] Cows.
[d] Data for 1895.
[e] Including buffaloes.
[f] Including mules and asses.
[g] On December 31 of preceding year.
[h] Dairy cows 2 years old or over.
[i] On farms.
[j] Including cows kept for breeding purposes.
[k] Including goats.
[l] Census, December 31, 1900.
[m] Cows and heifers in milk and with calf.
[n] Used for agriculture, and unbroken.
[o] Including buffalo calves.
[p] Data only for those States for which official figures are available.
[q] Of which 387,068 in Rajgark and Alwar include goats.

Live stock of countries named—Continued.

Country.	Year.	Cattle.		Horses.	Mules.	Sheep.	Swine.
		Total.	Dairy cows.				
ASIA—continued.							
Ceylon	1909	1,509,554	....	4,042	....	96,335	97,148
Cochin China	1903	109,000	....	11,243	....	....	709,400
Cyprus	1910	62,964	....	*a* 67,709	....	*b* 315,756	*c* 31,690
Hongkong	1908	1,482	....	195	....	....	....
Japanese Empire:							
Japan	*d* 1909	1,297,974	....	1,494,506	....	4,085	284,729
Formosa	*d* 1909	*e* 138,928	....	167	....	....	1,230,597
Total Japanese Empire	*d* 1909	1,436,902	....	1,494,673	....	4,085	1,515,326
Dutch East Indies:							
Java and Madura	1905	2,654,461	....	363,974	....	....	....
Other	1905	449,268	....	118,645	....	....	....
Total Dutch East Indies	1905	3,103,729	....	482,619	....	....	....
Philippine Islands	1903	127,559	....	144,171	290	30,428	1,179,371
Russia:							
Central Asia	1908	1,926,983	....	2,004,328	....	*f* 7,532,749	80,016
Siberia	1908	4,026,822	....	3,138,883	....	*f* 4,078,550	864,106
Transcaucasia	1902	2,304,977	....	388,936	....	6,302,258	309,479
Other	1903	2,343,000	....	1,624,000	....	5,443,000	186,400
Total Russia, Asiatic	....	10,601,782	....	7,156,147	....	23,356,557	1,440,001
Siam	1904	2,209,522	....	71,624	....	....	....
Straits Settlements and Labuan	1909	40,349	....	2,809	....	....	113,453
Turkey, Asiatic	....	3,000,000	....	800,000	....	45,000,000	....
Total	....	130,580,833	....	11,902,324	104,084	92,848,787	5,086,389
AFRICA.							
Algeria	1908	1,092,202	....	236,168	187,714	9,632,177	102,585
Basutoland	1904	213,361	....	64,621	*g* 26	*g* 2,794	*g* 476
British East Africa	1910	750,000	....	415	....	5,105,000	*h* 2,493
Egypt	1909	725,116	....	*i* 54,666	*j* 10,000	....	....
Eritrea	1905	250,891	....	*a* 29,789	....	*f* 736,132	....
Gambia	1907	82,781	....	3,851	....	....	....
German East Africa	1905	523,052	....	73	79	1,560,000	1,447
German Southwest Africa	1909	96,112	....	8,271	4,636	300,722	2,917
Madagascar	1905	2,867,612	*k* 1,118,162	1,074	464	333,454	522,021
Mauritius *l*	1909	13,121	....	608	113	1,523	3,805
Mayotte	(*m*)	47,894	....	21	15	124	....
Nyasaland Protectorate	1910	57,658	....	*a* 229	....	17,844	14,221
Reunion	(*m*)	4,720	....	1,780	4,534	4,583	....
Rhodesia	1909	271,072	....	*n* 1,661	....	215,715	....
St. Helena	1901	1,014	....	120	....	2,094	280
Seychelles	1909	1,000	....	150	....	200	6,000
Sierra Leone	1909	451	....	33	....	447	56
Southern Nigeria (Lagos)	1902	1,522	....	108	....	1,610	2,426
Sudan (Anglo-Egyptian) *o*	*p* 1908	340,372	....	8,251	....	952,950	....
Tunis	*q* 1909	159,272	....	28,772	16,002	585,027	10,771
Uganda Protectorate	1909	468,027	....	28	....	471,297	600

a Includes mules and asses.
b Not less than 1 year old; 30 per cent may be added for those less than 1 year old.
c Data for 1908.
d On December 31 of preceding year.
e Including 138,121 zebu cattle and 807 imported and cross-bred.
f Including goats.
g Excluding animals owned by natives.
h Census, 1909.
i Data for 1907.
j Data for 1900.
k Cows.
l On sugar estates only.
m Official estimate furnished by the French Embassy to the United States under date of May 4, 1906.
n Number of horses, mules, and asses owned by natives.
o Animals assessed for tribute and tax.
p On December 31 of preceding year.
q January 1.

Live stock of countries named—Continued.

Country.	Year.	Cattle.		Horses.	Mules.	Sheep.	Swine.
		Total.	Dairy cows.				
AFRICA—continued.							
Union of South Africa:							
Cape of Good Hope	1904	1,954,390	540,310	255,060	64,433	[a]18,807,168	385,945
Natal	1909	502,212	....	58,186	7,032	1,068,996	77,238
Orange Free State	1909	721,258	....	132,574	4,674	7,481,251	52,983
Transvaal	1909	899,673	....	125,951	9,011	3,011,906	[b] 167,879
Total Union of South Africa	....	4,077,533	....	571,771	85,150	30,369,321	684,045
Total	....	12,044,783	....	1,012,460	308,733	50,293,014	1,354,143
OCEANIA.							
Australia:							
Queensland	[c]1909	4,711,782	....	555,613	....	19,593,791	124,803
New South Wales	[c]1909	3,027,704	....	604,758	....	46,187,678	237,843
Victoria	[c]1910	1,549,640	....	442,829	....	12,937,983	217,921
South Australia	[c]1910	758,080	....	253,884	....	6,475,431	81,797
Western Australia	[c]1909	792,217	29,176	125,315	294	4,731,737	47,062
Tasmania	[c]1910	199,945	....	40,492	....	1,734,761	55,705
Total Australia	....	11,039,368	....	2,022,891	294	91,661,381	765,131
Fiji	1909	34,049	....	4,857	....	6,758	[b] 3,716
New Caledonia	(d)	73,862	....	2,938	12	9,442	2,438
New Zealand [e]	1908	1,773,326	....	363,259	[f] 519	[a]23,480,707	245,092
Territory of Papua	1909	664	....	222	....	36	198
Total	....	12,921,269	....	2,394,167	825	115,158,324	1,016,575
Grand total	....	448,459,624	....	96,404,339	7,747,843	605,050,853	137,448,104

Country.	Year.	Asses.	Buffaloes.	Camels.	Goats.	Reindeer.
NORTH AMERICA.						
United States:						
Contiguous—						
On farms	1900	94,165	....	....	1,870,599	....
Not on farms	1900	15,847	....	....	78,353	....
Noncontiguous—						
Alaska	1906	....	....	....	....	12,828
Hawaii [g]	1900	1,438	....	....	653	....
Porto Rico	1899	1,085	....	....	15,991	....
Total United States (except Philippine Islands)	....	112,535	....	....	1,965,596	12,828
Central America:						
Costa Rica	1907	67	....	....	670	....
Honduras	1909	2,373	....	....	....	....
Nicaragua	1908	1,343	....	....	979	....
Panama	1907	47	....	....	3,000	....
Mexico	1902	287,991	....	....	4,206,011	....
Newfoundland	1901	....	....	....	17,355	450
West Indies:						
British—						
Barbados	1907	3,887	....	....	....	....
Jamaica	1908	....	....	....	16,250	....
Trinidad and Tobago	[h] 1909	....	....	....	6,451	....
Cuba	1910	3,340	....	....	[i] 18,564	....
Dutch	1908	5,598	....	....	50,941	....
Guadeloupe	(d)	4,394	....	....	13,902	....
Total	....	421,575	....	....	6,299,719	13,278

[a] Census, 1909.
[b] Data for 1908.
[c] Year ending March 31.
[d] Official estimate furnished by the French Embassy to the United States under date of May 4, 1906.
[e] Including animals owned by Maoris.
[f] Including asses.
[g] On farms.
[h] December 31 preceding year.
[i] Census for 1899.

Live stock of countries named—Continued.

Country.	Year.	Asses.	Buffaloes.	Camels.	Goats.	Reindeer.
SOUTH AMERICA.						
Argentina	1908	285,088			3,245,086	
British Guiana	1907	5,750			13,500	
Chile	1908				343,810	
Colombia					361,000	
Dutch Guiana	1908	527			1,265	
Paraguay	1908				32,334	
Uruguay	1908	4,428			19,951	
Venezuela	1899	312,810			1,667,272	
Total		608,603			5,684,218	
EUROPE.						
Austria-Hungary:						
Austria	1900	46,324			1,019,664	
Hungary	1895	23,855	133,000		[a] 308,997	
Bosnia-Herzegovina	1895				1,447,049	
Total Austria-Hungary		70,179	133,000		2,775,710	
Belgium	1905				257,669	
Bulgaria	[b] 1906	124,080	476,872		1,384,116	
Denmark	1903				38,984	
Faroe Islands	1909				13	
Finland	1907				6,279	133,749
France	[c] 1909	363,090			1,424,870	
Germany	1907	10,349			3,533,970	
Greece	1902	141,179			3,339,409	
Iceland	1908				520	
Italy	1908	849,577	19,362		2,714,513	
Luxemburg	1907	27			11,344	
Malta	1909	3,740			20,813	
Montenegro					100,000	
Netherlands	1904				165,497	
Norway	[c] 1907				296,442	142,623
Portugal	1906	144,089			1,034,218	
Roumania	1900	7,186	43,475		232,515	
Russia:						
Russia proper	1905			224,500		347,000
Poland				1,000		
Total Russia, European				225,500		347,000
Servia	1905	1,247	7,710		510,063	
Spain	1909	834,709		3,336	3,285,320	
Sweden	1909				65,887	237,253
Switzerland	1906	1,679			362,117	
United Kingdom: Ireland	1910	240,677			242,614	
Total		2,791,808	680,419	228,836	21,802,883	860,625
ASIA.						
British India:						
British Provinces	1909	1,298,508	15,854,557	444,562	31,841,137	
Native States [d]	1908	[e] 146,877	1,323,560	51,809	2,963,050	
Total British India		1,445,385	17,178,117	496,371	34,804,187	
Ceylon	1908		579,069		174,072	
Cochin China	1903		241,750			
Cyprus	1909			1,151	[f] 274,343	
Hongkong	1908				113	
Japanese Empire:						
Japan	1909				83,352	
Formosa	[c] 1909		276,242		143,684	
Total Japanese Empire	1909		276,242		227,036	

[a] Data for 1909

[b] December 31 preceding year.

[c] On December 1 of preceding year.

[d] Data only for those States for which official estimates are available.

[e] Of which 58,495 in Alwar, Indore, Gwalior, and Marwar includes mules.

[f] Not less than 1 year old; 30 per cent may be added for those less than 1 year old.

Live stock of countries named—Continued.

Country.	Year.	Asses.	Buffaloes.	Camels.	Goats.	Reindeer.
ASIA—continued.						
Dutch East Indies:						
Java and Madura	1905		2,186,993			
Other	1905		446,540			
Total Dutch East Indies	1905		2,633,533			
Philippine Islands	1903		[a] 640,871		124,334	
Russia:						
Central Asia (4 provinces)	1903			365,000		
Siberia (4 provinces)	1903			500		38,700
Transcaucasia	1902	122,312	338,042	17,122	745,086	
Other	1903	58,500		296,000	802,000	20,000
Total Russia, Asiatic		180,812	338,042	678,622	1,547,086	58,700
Siam [b]	1904		2,288,956			
Turkey, Asiatic		2,500,000			9,000,000	
Total		4,126,197	24,176,580	1,176,144	46,151,171	58,700
AFRICA.						
Algeria	1908	271,794		204,715	4,199,096	
Basutoland	1904	[c] 10			1,625	
British East Africa	1908				1,591,206	
Egypt	1900	120,000	[d] 728,284	40,000		
Eritrea	1905			46,853		
German East Africa	1905	8,777		24	1,820,000	
German Southwest Africa	1909	5,189		240	242,023	
Madagascar	1905	411			66,747	
Mauritius	1908	22			6,732	
Mayotte	([e])	58			1,508	
Nyasaland Protectorate	1909				102,357	
Reunion	([e])	1,916			4,156	
Rhodesia	1908				593,860	
St. Helena	1908	774			1,001	
Seychelles	1908				500	
Southern Nigeria Colony (Lagos)	1902	19,289			2,600	
Soudan (Anglo-Egyptian)	[f] 1908			123,705	846,544	
Tunis	[g] 1909	63,188		106,175	342,249	
Union of South Africa:						
Cape of Good Hope	1904	100,470			[h] 7,376,346	
Natal	1909	10,330			910,848	
Orange Free State	1908	5,323			1,251,308	
Transvaal	1908	26,510			1,525,705	
Total Union of South Africa		142,633			11,064,207	
Total		634,061	728,284	521,712	20,886,411	
OCEANIA.						
Australia:						
New South Wales	1905			853	37,716	
South Australia	1905				26,948	
Western Australia	[i] 1910	1,858		3,257	31,988	
Tasmania	1908				1,460	
Total		1,858		4,110	98,112	
Fiji	1908				19,446	
New Caledonia	([e])				6,111	
New Zealand	1891				[j] 9,055	
Territory of Papua	1908				523	
Total		1,858		4,110	133,247	
Grand total		8,584,102	25,585,283	1,930,802	100,957,649	932,603

[a] Carabaos.
[b] Number of domesticated elephants returned as 4,072.
[c] Excluding animals owned by natives.
[d] Data for 1909.
[e] Official estimate furnished by the French Embassy to the United States under date of May 4, 1906.
[f] Animals assessed for tribute or tax.
[g] January 1.
[h] Census for 1909.
[i] On December 31 of preceding year.
[j] Including goats owned by Maoris.

International trade in hides and skins. [a]

[Substantially the international trade of the world. This table gives the classification as found in the original returns, and the summary statements for "All countries" represent the total for each class only so far as it is disclosed in the original returns.]

EXPORTS.

Country.	Year beginning—	Kind of hides and skins.	1905.	1906.	1907.	1908.	1909.
			Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Argentina	Jan. 1	Cattle, dried	53,457,674	51,119,435	45,755,984	64,790,653	80,160,689
		Cattle, salted	90,239,588	72,476,948	74,119,129	77,440,822	116,223,772
		Goat	4,205,350	4,161,487	2,062,001	5,089,831	5,361,735
		Horse, dried	2,801,828	680,007	2,214,675	2,577,159	5,763,329
		Horse, salted	1,731,726	3,597,399	488,096	358,628	466,423
		Kid	971,729	914,222	871,031	677,099	1,233,604
		Sheep	66,535,492	52,428,116	54,449,234	61,634,593	80,202,929
Austria-Hungary	Jan. 1	Calf, dried	6,855,933	4,092,440	4,249,850	4,709,293	4,137,814
		Calf, salted	9,100,680	8,290,261	11,650,104	18,618,471	23,128,018
		Cattle, dried	5,676,240	6,112,126	6,570,214	7,011,208	7,383,646
		Cattle, salted	13,682,766	9,728,115	11,133,562	18,017,273	38,838,438
		Goat	1,977,987	2,512,150	2,346,820	2,109,391	2,374,134
		Horse, dried	2,297,437	1,821,679	777,570	1,705,757	1,722,013
		Horse, salted	3,808,485	3,139,578	2,417,148	2,002,115	3,907,433
		Kid	1,836,009	1,213,203	830,040	1,310,648	1,282,416
		Lamb	3,535,111	3,538,859	2,358,284	3,113,588	3,461,222
		Sheep	4,251,393	5,061,371	3,887,630	3,217,866	4,014,136
		Hides and skins, unclassified			1,263,248	1,195,126	1,162,045
Belgium	Jan. 1	do	101,081,934	102,400,208	97,433,761	113,111,973	108,875,306
Brazil	Jan. 1	Deer	176,295	195,559	215,636	251,362	(b)
		Goat	3,361,740	3,842,815	4,998,211	5,685,614	8,591,765
		Hides, dried, not elsewhere specified	17,328,272	21,667,230	15,325,249	15,643,937	c 78,887,261
		Hides, salted, not elsewhere specified	42,135,260	50,567,124	54,149,306	51,399,285	
		Horse	28,936	18,660	1,162	2,802	d 2,802
		Lamb	5,143	64,218	23,140	207,155	(b)
		Sheep	959,755	869,285	1,076,927	1,675,341	(b)
		Hides and skins, unclassified	33,113	54,227	60,504	35,344	(b)
British India	Jan. 1	Hides, unclassified	94,061,280	126,917,238	89,685,904	80,079,216	87,856,048
		Goat	40,191,648	49,057,568	32,639,040	41,339,200	66,858,400
		Skins, unclassified	14,994,861	9,473,968	4,520,624	2,115,792	3,794,336
British South Africa [e]	Jan. 1	Calf	96,562	67,841	47,046	16,419	163,352
		Cattle	2,970,438	4,566,062	7,123,557	9,357,295	11,652,984
		Goat	5,461,295	5,208,577	6,611,384	6,920,990	8,157,675
		Sheep	11,713,890	14,523,317	17,847,237	19,302,241	23,780,392
		Hides and skins					1,521

[a] See "General note," p. 507.
[b] Included in "Goat."
[c] Including deer, lamb, and sheep skins, also "hides and skins, unclassified."
[d] Year preceding.
[e] Cape Colony before 1906.

International trade in hides and skins—Continued.

EXPORTS—Continued.

Country.	Year beginning—	Kind of hides and skins.	1905.	1906.	1907.	1908.	1909.
			Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Canada [a]	Jan. 1	Sheep	242,000	247,000	293,000	37,292	413,340
		Hides and skins, not elsewhere specified	31,000,000	33,000,000	33,000,000	42,000,000	43,600,000
China	Jan. 1	Hides and skins, unclassified	51,013,930	56,615,921	65,377,054	52,146,712	66,624,038
Cuba	Jan. 1	Cattle	4,622,613	6,957,213	4,437,849	9,753,283	11,391,221
		Hides and skins, unclassified	198,299	247,823	3,370,215	35,270	1,024,649
Denmark	Jan. 1	do	19,315,629	18,112,373	16,509,849	19,318,130	20,491,426
Dutch East Indies	Jan. 1	do	14,039,571	15,276,688	15,796,758	15,317,515	[b] 16,617,221
Egypt	Jan. 1	Cattle and calf	4,517,315	5,718,381	4,944,008	5,031,305	8,716,382
		Sheep and goat [c]	2,620,819	3,196,993	3,686,466	2,587,329	3,325,525
France	Jan. 1	Calf	17,130,187	23,197,713	29,349,251	28,014,132	25,492,892
		Goat	10,333,119	8,400,492	6,118,708	6,062,190	8,298,114
		Kid	626,914	937,816	426,594	807,333	922,405
		Lamb	1,416,190	1,324,978	1,040,361	1,403,462	2,602,971
		Large	61,880,962	69,136,285	71,435,485	65,527,539	75,216,322
		Sheep	10,099,143	11,967,350	14,950,644	12,376,307	14,894,498
		Hides and skins, unclassified	7,776,412	6,723,877	2,388,928	2,510,183	1,547,850
Germany [d]	Jan. 1	Calf, green	10,235,649	16,865,579	17,197,595	22,823,349	23,860,386
		Calf, dried	9,591,125				
		Cattle, green	65,859,114	80,434,531	77,366,579	92,967,587	104,211,662
		Cattle, dried	11,591,258				
		Goat, with hair on	3,744,110	3,198,907	1,949,106	2,633,862	3,272,067
		Goat, without hair	19,401				
		Horse, green	16,119,978	18,055,854	11,701,472	12,673,490	15,580,349
		Horse, dried	1,629,216				
		Sheep	823,206	4,766,834	5,172,754	5,125,967	6,307,802
		Hides and skins, unclassified	604,547	605,830	563,722	284,176	111,599
Italy	Jan. 1	Cattle and calf	19,357,463	25,858,232	24,820,296	35,327,084	41,929,039
		Sheep and goat	4,616,048	4,502,580	3,511,726	4,815,996	4,723,577
		Hides and skins, unclassified	2,737,700	910,729	1,600,595	1,474,672	1,755,964
Korea	Jan. 1	Cattle	2,273,200	2,209,733	2,423,600	2,638,704	4,507,979
Mexico	Jan. 1	Alligator	134,952	179,081	199,627	329,018	370,213
		Cattle	14,392,088	18,087,112	17,930,676	19,811,681	31,327,273
		Deer	572,190	730,559	802,260	734,196	802,115
		Goat	6,356,232	7,634,630	6,649,277	7,817,338	7,884,509
		Sheep	935	17,128	16,698	14,158	131,903
Netherlands	Jan. 1	Hides, dried	22,724,931	24,050,379	19,844,098	18,703,003	21,283,885
		Hides, fresh	246,435	237,905	165,450	149,756	243,363
		Hides, salted	32,383,298	34,507,045	32,386,777	36,715,583	45,216,518
		Sheep	1,064,492	1,322,985	1,820,636	2,651,278	2,264,680
New Zealand	Jan. 1	Hides, unclassified [3]	1,926,000	2,555,000	3,171,000	3,398,435	3,503,185
		Sheep	12,799,222	14,364,574	16,158,949	14,462,904	17,716,124
		Skins, unclassified	103,000	276,000	410,000	280,681	390,660

Peru	Jan. 1	Hides and skins, unclassified	6,954,866	7,941,310	6,339,384	e 6,339,384	e 6,339,384
Russia	Jan. 1	Hides, large	14,284,165	31,578,585	15,103,890	6,377,701	b 20,042,604
		Hides, small	24,540,778	26,235,263	24,572,738	24,924,224	b 40,988,028
		Sheep and goats	19,206,232	35,616,899	26,956,761	14,742,726	b 17,948,062
		Hides and skins, unclassified			2,033,078	4,609,799	b 5,124,406
Singapore	Jan. 1	Hides, unclassified	7,268,133	7,510,899	6,521,667	5,107,467	5,879,867
Spain	Jan. 1	Goat	1,718,702	1,017,973	1,753,772	1,976,426	2,312,167
		Sheep	8,383,804	8,042,369	5,436,053	5,243,085	7,165,781
		Hides and skins, unclassified	9,359,902	12,536,788	7,595,300	6,925,882	8,435,009
Sweden	Jan. 1	do	15,709,168	16,247,094	13,230,260	14,953,738	19,919,895
Switzerland	Jan. 1	Hides, unclassified	12,695,138	13,414,023	14,990,599	16,235,057	15,471,001
		Skins, unclassified	6,002,190	5,744,584	6,713,735	7,115,858	7,341,979
United Kingdom	Jan. 1	Hides, unclassified	29,127,328	31,359,776	21,690,144	27,167,728	31,929,408
		Skins, unclassified c	46,961,937	37,835,119	35,403,044	22,841,466	38,312,186
United States	Jan. 1	Hides and skins, unclassified	8,654,522	16,025,299	11,126,157	14,915,857	9,922,887
Uruguay	July 1	Calf	1,795,344	3,243,609	2,500,131	f 2,500,131	e 2,500,131
		Cattle, dried	14,056,903	15,997,913	12,318,137	20,747,715	f 20,747,715
		Cattle, salted c	30,875,194	24,357,872	23,310,784	22,812,832	f 22,812,832
		Goat	34	4,588	74	f 74	e 74
		Horse, dried c	515,104	430,896	247,968	313,536	f 313,536
		Horse, salted c	124,608	60,514	225,016	117,172	f 117,172
		Lamb	316,719	294,330	220,037	f 220,037	e 220,037
		Sheep	14,990,823	13,795,738	14,644,643	f 14,644,643	e 14,644,643
Venezuela	July 1	Cattle	7,929,730	6,399,486	4,362,636	7,084,952	7,644,206
		Deer	349,159	349,159	340,890	438,777	350,013
		Goat	1,479,815	1,402,444	1,543,478	1,816,262	2,134,020
Other countries		Hides:					
		Cattle, including buffalo	46,832,873	36,232,222	30,604,656	32,414,366	a 42,895,750
		Horse	471,232	507,364	477,873	458,255	a 533,086
		Skins:					
		Calf	2,435,640	2,443,922	3,731,792	3,264,842	a 5,136,704
		Deer	859,467	934,174	1,172,320	890,971	a 918,633
		Goat	8,010,735	6,324,174	10,408,252	12,903,566	a 16,672,407
		Kid	1,040,412	580,236	463,340	787,323	a 584,151
		Sheep and lamb	11,014,904	10,441,862	17,887,219	16,722,711	a 21,837,858
		Sheep and goat, mixed	19,280,233	3,551,489	7,428,674	12,160,599	a 12,298,808
		Hides and skins:					
		Large, not otherwise classified	303,172		14,733,890	13,195,745	a 14,405,687
		Small, not otherwise classified			1,871,942	6,497,788	a 1,340,721
		Unclassified	28,787,580	47,437,245	38,849,397	28,231,928	a 38,191,068
Total			1,489,099,169	1,570,014,200	1,465,654,102	1,550,417,673	1,881,832,283

a Estimated.
b Preliminary.
c Number of pounds computed from stated number of hides or skins.
d Not including free ports prior to March 1, 1906.
e Data for 1907.
f Year preceding.

International trade in hides and skins—Continued.

EXPORTS—Continued.

Country.	Year beginning—	Kind of hides and skins.	1905.	1906.	1907.	1908.	1909.
RECAPITULATION.							
All countries		Hides:	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
		Cattle, including buffalo	364,430,009	335,039,138	317,757,363	444,041,001	573,265,180
		Cattle and calf, mixed	23,904,778	31,606,616	29,764,304	40,358,389	50,636,411
		Horse	29,559,465	28,572,981	18,550,980	21,694,493	29,166,721
		Skins:					
		Alligator	134,952	179,081	190,627	329,018	370,243
		Calf	57,557,376	58,777,451	68,725,769	79,946,610	84,809,957
		Deer	1,957,411	2,209,852	2,531,106	2,596,669	2,353,588
		Goat	86,890,798	92,798,805	77,060,123	115,088,471	157,665,886
		Kid	4,475,094	3,675,507	2,591,005	4,199,356	4,683,030
		Lamb	5,333,163	5,222,385	3,641,822	6,176,405	17,455,573
		Sheep	143,187,824	137,848,220	153,941,624	163,145,550	226,569,845
		Sheep and goat, mixed	45,723,352	46,867,881	41,613,627	48,116,764	34,126,197
		Hides and skins:					
		Large, not otherwise classified	76,468,299	100,714,870	101,273,265	85,100,985	109,664,613
		Small, not otherwise classified	24,540,778	26,235,263	26,444,680	31,422,012	42,328,749
		Unclassified	624,935,870	700,266,150	621,567,807	508,201,920	548,786,290
Total			1,489,099,169	1,570,014,200	1,465,654,102	1,550,417,673	1,881,832,283

IMPORTS.

Country.	Year beginning—	Kind of hides and skins.	1905.	1906.	1907.	1908.	1909.
Austria-Hungary	Jan. 1	Calf, dried	1,056,896	1,641,782	1,608,492	912,714	768,744
		Calf, green	994,505	1,795,444	1,864,449	1,959,168	1,538,811
		Cattle, dried	25,180,311	43,766,156	36,294,251	26,373,011	27,296,696
		Cattle, green	17,510,144	31,964,594	27,210,106	30,167,166	15,321,750
		Goat	1,410,076	1,279,563	1,213,407	1,055,132	1,335,106
		Horse, dried	360,676	494,196	59,304	72,532	77,602
		Horse, green	224,871	500,670	630,301	409,178	106,482
		Kid	723,557	638,899	570,997	471,789	425,488
		Lamb	8,602,135	10,561,242	7,591,616	10,358,637	9,719,640
		Sheep	5,061,592	6,890,767	4,843,334	4,138,737	3,422,201
		Hides and skins, unclassified	[1]	[1]	859,803	698,645	678,355
Belgium	Jan. 1	Hides, green	135,911,437	142,197,407	137,852,633	151,932,264	164,383,378
British India	Jan. 1	Hides, unclassified	9,433,956	9,522,643	10,799,319	9,767,159	10,172,863
		Skins, unclassified	4,444,104	5,274,370	4,934,990	9,022,671	6,251,289
Canada	Jan. 1	Hides and skins, unclassified	[1]	[1]	[1]	28,659,616	38,915,816
Denmark	Jan. 1	do	7,848,454	10,294,482	9,504,125	8,744,633	9,067,520

Finland	Jan. 1	Hides, dried	1,898,433	2,631,124	2,693,193	2,504,411	2,561,542
		Hides, green	4,263,421	5,529,891	6,257,272	3,593,518	6,885,190
		Sheep	56,061	68,050	163,285	295,236	122,523
France	Jan. 1	Calf	7,980,756	9,045,423	6,593,583	7,163,037	8,520,999
		Goat	23,110,243	23,276,399	19,772,593	19,311,766	22,539,751
		Kid	4,544,123	4,935,708	3,793,564	4,724,946	5,199,519
		Lamb	378,553	374,565	251,327	254,854	313,653
		Large	98,515,340	106,831,132	97,557,830	87,812,960	107,218,957
		Sheep	2,532,200	3,201,332	3,160,105	5,825,493	4,556,247
		Hides and skins, unclassified	3,209,189	1,674,851	1,415,791	1,695,898	2,088,197
Germany b	Jan. 1	Buffalo	(a)	(a)	2,927,077	2,640,255	3,291,909
		Calf, dried	22,145,869	18,811,819	14,672,421	14,213,622	16,510,673
		Calf, green	32,244,120	38,531,942	39,555,328	50,099,621	58,128,217
		Cattle, dried	70,228,234	77,797,583	74,161,500	68,589,538	80,868,696
		Cattle, green	143,851,586	177,694,958	161,336,884	172,921,731	167,881,392
		Goat, with hair on	11,042,952	14,543,450	11,691,330	15,106,731	19,557,227
		Goat, without hair	38,110				
		Horse, dried	4,592,889	6,688,823	5,081,433	3,193,615	5,402,152
		Horse, green	25,891,742	30,573,918	21,788,279	18,303,213	20,312,964
		Lamb	(a)	(a)	308,127	130,073	95,900
		Sheep	746,485	1,345,040	808,435	1,730,187	976,638
		Hides and skins, unclassified	3,340,443	2,157,002	1,861,008	1,706,818	1,659,402
Greece	Jan. 1	Hides, unclassified	6,055,809	5,286,300	5,587,396	5,535,946	5,499,037
Italy	Jan. 1	Calf	39,240,949	44,294,383	2,207,768	2,596,824	2,075,190
		Cattle			38,113,505	40,243,390	41,005,340
		Sheep	8,740,884	11,596,532	8,082,806	6,738,868	5,768,115
		Goat			301,372	783,302	316,581
		Kid	(a)	(a)	71,650	115,302	89,468
		Lamb	(a)	(a)	661,166	216,955	313,036
		Hides and skins, unclassified	181,881	277,782	168,133	643,529	330,868
Japan	Jan. 1	Cattle	7,402,046	5,450,564	8,265,319	5,588,303	7,659,635
		Deer	426,217	700,708	751,884	675,860	635,531
Netherlands	Jan. 1	Hides, dried	29,760,509	30,643,584	29,418,436	27,211,451	30,073,802
		Hides, fresh	15,141	5,304	9,090	15,653	32,566
		Hides, salted	21,586,003	27,913,664	20,705,512	26,239,687	34,009,172
		Sheep	2,367,808	2,094,529	3,226,381	4,030,276	4,314,752
Norway	Jan. 1	Hides and skins, unclassified	8,722,279	10,507,625	10,191,328	11,209,613	14,991,222
Portugal	Jan. 1	Hides, dried	4,216,487	5,227,560	5,404,596	5,681,918	5,117,796
		Hides, green	181,630	152,868	142,057	105,670	106,894
		Hides, not elsewhere specified	414	15,279	496	....	....
Roumania	Jan. 1	Buffalo	83,987	7,512,516	6,301,669	7,834,567	c 7,834,567
		Cattle	2,252,952				
		Calf	13,728	33,363	50,523	59,170	c 59,170
		Sheep, lamb, and goat	157,536	700,517	653,212	533,713	d 533,713
		Hides and skins, unclassified	136,312	65,949	10,100	39,014	c 38,827
Russia	Jan. 1	Hides, dry	12,668,515	10,147,336	10,633,089	13,646,485	d 9,822,682
		Hides, green	51,753,326	45,639,682	59,806,336	83,458,956	d 74,284,030
		Goat and kid	....	1,694,232	1,795,384	2,310,030	d 1,592,575
		Sheep	....	....	7,841,353	8,605,030	d 1,119,497
		Hides and skins, unclassified	....	....	....	2,224,946	d 982,268

a No data.
b Not including free ports prior to March 1, 1906.
c Year preceding.
d Preliminary,

International trade in hides and skins—Continued.

IMPORTS—Continued.

Country.	Year beginning—	Kind of hides and skins.	1905.	1906.	1907.	1908.	1909.
			Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Singapore	Jan. 1	Hides, unclassified	8,191,200	9,236,000	8,492,933	8,487,733	8,969,733
Spain	Jan. 1	Hides and skins, unclassified	14,247,484	17,281,585	17,288,011	18,394,741	16,940,854
Sweden	Jan. 1	do	18,939,762	21,290,081	20,360,265	17,034,689	22,970,005
United Kingdom	Jan. 1	Goat [a]	3,757,000	9,330,000	7,931,000	7,733,000	9,133,930
		Hides, unclassified	60,628,848	70,661,696	70,407,232	82,058,032	87,495,744
		Sheep [a]	34,694,000	42,124,000	[b] 6,675,000	[b] 403,000	(c)
		Hides and skins, unclassified	378,000	1,135,000	568,000	(d)	442,648
		Calf					[e] 47,062,988
United States	Jan. 1	Cattle	136,612,360	144,040,983	122,932,034	137,922,575	279,044,262
		Goat	102,940,811	109,232,719	86,252,338	75,857,983	115,167,176
		Horse					[g] 11,237,915
		Sheep [f]				20,138,987	63,771,930
		Hides and skins, unclassified	141,587,241	145,253,161	146,363,578	94,527,337	56,492,232
Other countries		Hides:					
		Cattle	7,143,387	8,324,330	8,595,547	8,890,151	[g] 10,099,924
		Horse		5,543	15,066	3,210	[g] 18,170
		Skins:					
		Calf	128,604	131,676	100,950	138,252	[g] 174,009
		Deer				4,502	
		Goat	665,581	601,551	441,129	65,036	[g] 507,168
		Kid		23,316	12,301	13,940	[g] 12,288
		Sheep	741,964	1,199,522	802,674	582,216	[g] 1,261,469
		Sheep and goat, mixed	3,849	57,770	431	149,209	[g] 100,202
		Hides and skins:					
		Large, not otherwise classified	328,180		229,212	882,098	[g] 404,639
		Small, not otherwise classified	12,270,221		1,700	331,882	[g] 4,892
		Unclassified		13,180,575	31,783,890	21,876,093	[g] 23,753,154
Total			1,418,566,988	1,595,595,210	1,471,494,864	1,518,534,898	1,827,936,915

RECAPITULATION.

All countries		Hides:					
		Buffalo	83,987		2,927,077	2,746,375	3,872,449
		Cattle	410,211,290	496,551,684	483,310,815	523,984,418	668,736,796
		Cattle and calf, mixed	39,240,949	44,294,383			
		Horse	31,073,668	38,263,450	27,574,383	22,031,991	37,201,936
		Skins:					
		Calf	64,564,498	69,981,449	66,653,454	77,142,708	134,868,831
		Deer	426,217	790,708	751,884	680,311	635,531
		Goat	142,964,803	159,991,614	129,428,553	121,506,263	168,651,182
		Kid	5,267,680	5,654,223	4,453,512	6,166,863	7,234,531
		Lamb	8,980,988	10,935,807	8,812,536	11,337,340	11,192,575
		Sheep	46,200,110	56,923,040	35,603,373	52,764,540	84,492,426
		Sheep and goat, mixed	8,902,269	12,354,819	653,643	1,138,009	1,088,998
		Hides and skins:					
		Large, not otherwise classified	98,843,520	106,831,132	97,787,042	88,695,058	107,623,596
		Small, not otherwise classified	561,807,009	594,202,901	1,700	331,882	4,892
		Unclassified			613,536,892	609,809,140	602,333,172
Total			1,418,566,988	1,595,595,210	1,471,494,864	1,518,534,898	1,827,936,915

a Number of pounds computed from stated number of hides and skins.
b Pickled sheepskins only. Sheepskins with wool left on are stated in weight since 1906, and not included.
c Excess of foreign exports over general imports, 1,784,142 pounds.
d Excess of foreign exports over general imports, 664,460 pounds.
e Data for July to December, inclusive.
f Included in "Hides and skins, unclassified" prior to July 1, 1908.
g Preliminary.

FARM ANIMALS AND THEIR PRODUCTS IN CONTINENTAL UNITED STATES.

HORSES AND MULES.

Number and farm value of horses and mules on farms in the United States, 1867–1911.

January 1—	Horses.			Mules.		
	Number.	Price per head Jan. 1.	Farm value Jan. 1.	Number.	Price per head Jan. 1.	Farm value Jan. 1.
1867	5,401,000	$59.05	$318,924,000	822,000	$66.94	$55,048,000
1868	5,757,000	54.27	312,416,000	856,000	56.04	47,954,000
1869	6,333,000	62.57	396,222,000	922,000	79.23	73,027,000
1870	8,249,000	67.43	556,251,000	1,180,000	90.42	106,654,000
1871	8,702,000	71.14	619,039,000	1,242,000	91.98	114,272,000
1872	8,991,000	67.41	606,111,000	1,276,000	87.14	111,222,000
1873	9,222,000	66.39	612,273,000	1,310,000	85.15	111,546,000
1874	9,334,000	65.15	608,073,000	1,339,000	81.35	108,953,000
1875	9,504,000	61.10	580,708,000	1,394,000	71.89	100,197,000
1876	9,735,000	57.29	557,747,000	1,414,000	66.46	94,001,000
1877	10,155,000	55.83	567,017,000	1,444,000	64.07	92,482,000
1878	10,330,000	56.63	584,999,000	1,638,000	62.03	101,579,000
1879	10,939,000	52.36	572,712,000	1,713,000	56.00	95,942,000
1880	11,202,000	54.75	613,297,000	1,730,000	61.26	105,948,000
1881	11,430,000	58.44	667,954,000	1,721,000	69.79	120,096,000
1882	10,522,000	58.53	615,825,000	1,835,000	71.35	130,945,000
1883	10,838,000	70.59	765,041,000	1,871,000	79.49	148,732,000
1884	11,170,000	74.64	833,734,000	1,914,000	84.22	161,215,000
1885	11,565,000	73.70	852,283,000	1,973,000	82.38	162,497,000
1886	12,078,000	71.27	860,823,000	2,053,000	79.60	163,381,000
1887	12,497,000	72.15	901,686,000	2,117,000	78.91	167,058,000
1888	13,173,000	71.82	946,096,000	2,192,000	79.78	174,854,000
1889	13,663,000	71.89	982,195,000	2,258,000	79.49	179,444,000
1890	14,214,000	68.84	978,517,000	2,331,000	78.25	182,394,000
1891	14,057,000	67.00	941,823,000	2,297,000	77.88	178,847,000
1892	15,498,000	65.01	1,007,594,000	2,315,000	75.55	174,882,000
1893	16,207,000	61.22	992,225,000	2,331,000	70.68	164,764,000
1894	16,081,000	47.83	769,225,000	2,352,000	62.17	146,233,000
1895	15,893,000	36.29	576,731,000	2,333,000	47.55	110,928,000
1896	15,124,000	33.07	500,140,000	2,279,000	45.29	103,204,000
1897	14,365,000	31.51	452,649,000	2,216,000	41.66	92,302,000
1898	13,961,000	34.26	478,362,000	2,190,000	43.88	96,110,000
1899	13,665,000	37.40	511,075,000	2,134,000	44.96	95,963,000
1900	13,538,000	44.61	603,969,000	2,086,000	53.55	111,717,000
1901	16,745,000	52.86	885,200,000	2,864,000	63.97	183,232,000
1902	16,531,000	58.61	968,935,000	2,757,000	67.61	186,412,000
1903	16,557,000	62.25	1,030,706,000	2,728,000	72.49	197,753,000
1904	16,736,000	67.93	1,136,940,000	2,758,000	78.88	217,533,000
1905	17,058,000	70.37	1,200,310,000	2,889,000	87.18	251,840,000
1906	18,719,000	80.72	1,510,890,000	3,404,000	98.31	334,681,000
1907	19,747,000	93.51	1,846,578,000	3,817,000	112.16	428,064,000
1908	19,992,000	93.41	1,867,530,000	3,869,000	107.76	416,939,000
1909	20,640,000	95.64	1,974,052,000	4,053,000	107.84	437,082,000
1910	21,040,000	108.19	2,276,363,000	4,123,000	119.84	494,095,000
1911	....	111.67	....	....	125.62	....

HORSES AND MULES—Continued.

Imports, exports, and average prices of horses and mules, 1892–1910.

Year ending June 30—	Imports of horses.			Exports of horses.			Exports of mules.		
	Number.	Value.	Average import price.	Number.	Value.	Average export price.	Number.	Value.	Average export price.
1892	14,074	$2,455,868	$174.50	3,226	$611,188	$189.46	1,965	$238,591	$121.42
1893	15,451	2,388,267	154.57	2,967	718,607	242.20	1,634	210,278	128.69
1894	6,166	1,319,572	214.01	5,246	1,108,995	211.40	2,063	240,961	116.80
1895	13,098	1,055,191	80.56	13,984	2,209,298	157.99	2,515	186,452	74.14
1896	9,991	662,591	66.32	25,126	3,530,703	140.52	5,918	406,161	68.63
1897	6,998	464,808	66.42	39,532	4,769,265	120.64	7,473	545,331	72.97
1898	3,085	414,899	134.49	51,150	6,176,569	120.75	8,098	664,789	82.09
1899	3,042	551,050	181.15	45,778	5,444,342	118.93	6,755	516,908	76.52
1900	3,102	596,592	192.32	64,722	7,612,616	117.62	43,369	3,919,478	90.38
1901	3,785	985,738	260.43	82,250	8,873,845	107.89	34,405	3,210,267	93.31
1902	4,832	1,577,234	326.41	103,020	10,048,046	97.53	27,586	2,692,298	97.60
1903	4,999	1,536,296	307.32	34,007	3,152,159	92.69	4,294	521,725	121.47
1904	4,726	1,460,287	308.99	42,001	3,189,100	75.93	3,658	412,971	112.90
1905	5,180	1,591,083	307.16	34,822	3,175,259	91.19	5,826	645,464	110.79
1906	6,021	1,716,675	285.11	40,087	4,365,981	108.91	7,167	989,639	138.08
1907	6,080	1,978,105	325.35	33,882	4,359,957	131.99	6,781	850,901	125.48
1908	5,487	1,604,392	292.40	19,000	2,612,587	137.50	6,609	990,667	149.90
1909	7,084	2,007,276	283.35	21,616	3,386,617	156.67	3,432	472,017	137.53
1910	11,620	3,296,022	283.65	28,910	4,081,157	141.17	4,512	614,094	136.10

CATTLE.

Imports, exports, and average prices of live cattle, 1892–1910.

Year ending June 30—	Imports.			Exports.		
	Number.	Value.	Average import price.	Number.	Value.	Average export price.
1892	2,168	$47,466	$21.89	394,607	$35,099,095	$88.95
1893	3,293	45,682	13.87	287,094	26,032,428	90.68
1894	1,592	18,704	11.75	359,278	33,461,922	93.14
1895	149,781	765,853	5.11	331,722	30,603,796	92.26
1896	217,826	1,509,856	6.93	372,461	34,560,672	92.79
1897	328,977	2,589,857	7.87	392,190	36,357,451	92.70
1898	291,589	2,913,223	9.99	439,255	37,827,500	86.12
1899	199,752	2,320,362	11.62	389,490	30,516,833	78.35
1900	181,006	2,257,694	12.47	397,286	30,635,153	77.11
1901	146,022	1,931,433	13.23	459,218	37,566,980	81.81
1902	96,027	1,608,722	16.75	392,884	29,902,212	76.11
1903	66,175	1,161,548	17.55	402,178	29,848,936	74.22
1904	16,056	310,737	19.35	593,409	42,256,291	71.21
1905	27,855	458,572	16.46	567,806	40,598,048	71.50
1906	29,019	548,430	18.90	584,239	42,081,170	72.03
1907	32,402	565,122	17.44	423,051	34,577,392	81.73
1908	92,356	1,507,310	16.32	349,210	29,339,134	84.02
1909	139,184	1,999,422	14.37	207,542	18,046,976	86.96
1910	195,138	2,999,824	15.37	139,430	12,200,154	87.50

CATTLE—Continued.

Number and value of milch cows and other cattle on farms in the United States, 1867–1911.

January 1—	Milch cows.			Other cattle.		
	Number.	Price per head Jan. 1.	Farm value Jan. 1.	Number.	Price per head Jan. 1.	Farm value Jan. 1.
1867	8,349,000	$28.74	$239,947,000	11,731,000	$15.79	$185,254,000
1868	8,692,000	26.56	230,817,000	11,942,000	15.06	179,888,000
1869	9,248,000	29.15	269,610,000	12,185,000	18.73	228,183,000
1870	10,096,000	32.70	330,175,000	15,388,000	18.87	290,401,000
1871	10,023,000	33.89	339,701,000	16,212,000	20.78	336,860,000
1872	10,304,000	29.45	303,438,000	16,390,000	18.12	296,932,000
1873	10,576,000	26.72	282,559,000	16,414,000	18.06	296,448,000
1874	10,705,000	25.63	274,326,000	16,218,000	17.55	284,706,000
1875	10,907,000	25.74	280,701,000	16,313,000	16.91	275,872,000
1876	11,085,000	25.61	283,879,000	16,785,000	17.00	285,387,000
1877	11,261,000	25.47	286,778,000	17,956,000	15.99	287,156,000
1878	11,300,000	25.74	290,898,000	19,223,000	16.72	321,346,000
1879	11,826,000	21.71	256,721,000	21,408,000	15.38	329,254,000
1880	12,027,000	23.27	279,899,000	21,231,000	16.10	341,761,000
1881	12,369,000	23.95	296,277,000	20,939,000	17.33	362,862,000
1882	12,612,000	25.89	326,489,000	23,280,000	19.89	463,070,000
1883	13,126,000	30.21	396,575,000	28,046,000	21.81	611,549,000
1884	13,501,000	31.37	423,487,000	29,046,000	23.52	683,229,000
1885	13,905,000	29.70	412,903,000	29,867,000	23.25	694,383,000
1886	14,235,000	27.40	389,986,000	31,275,000	21.17	661,956,000
1887	14,522,000	26.08	378,790,000	33,512,000	19.79	663,138,000
1888	14,856,000	24.65	366,252,000	34,378,000	17.79	611,751,000
1889	15,299,000	23.94	366,226,000	35,032,000	17.05	597,237,000
1890	15,953,000	22.14	353,152,000	36,849,000	15.21	560,625,000
1891	16,020,000	21.62	346,398,000	36,876,000	14.76	544,128,000
1892	16,416,000	21.40	351,378,000	37,651,000	15.16	570,749,000
1893	16,424,000	21.75	357,300,000	35,954,000	15.24	547,882,000
1894	16,487,000	21.77	358,999,000	36,608,000	14.66	536,790,000
1895	16,505,000	21.97	362,602,000	34,364,000	14.06	482,999,000
1896	16,138,000	22.55	363,956,000	32,085,000	15.86	508,928,000
1897	15,942,000	23.16	369,240,000	30,508,000	16.65	507,929,000
1898	15,841,000	27.45	434,814,000	29,264,000	20.92	612,297,000
1899	15,990,000	29.66	474,234,000	27,994,000	22.79	637,931,000
1900	16,292,000	31.60	514,812,000	27,610,000	24.97	689,486,000
1901	16,834,000	30.00	505,093,000	45,500,000	19.93	906,644,000
1902	16,697,000	29.23	488,130,000	44,728,000	18.76	839,126,000
1903	17,105,000	30.21	516,712,000	44,659,000	18.45	824,055,000
1904	17,420,000	29.21	508,841,000	43,629,000	16.32	712,178,000
1905	17,572,000	27.44	482,272,000	43,669,000	15.15	661,571,000
1906	19,794,000	29.44	582,789,000	47,068,000	15.85	746,172,000
1907	20,968,000	31.00	645,497,000	51,566,000	17.10	881,557,000
1908	21,194,000	30.67	650,057,000	50,073,000	16.89	845,938,000
1909	21,720,000	32.36	702,945,000	49,379,000	17.49	863,754,000
1910	21,801,000	35.79	780,308,000	47,279,000	19.41	917,453,000
1911	....	40.49	....	....	20.85	....

CATTLE—Continued.

Wholesale prices of cattle per 100 pounds, 1897–1910.

Date.	Chicago.		Cincinnati.		St. Louis.		Omaha.	
	Inferior to prime.		Fair to medium.		Good to choice native steers.		Native beeves.	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.
1897	$1.75	$5.75	$3.00	$4.00	$3.25	$5.25	$3.00	$5.20
1898	2.25	6.25	3.10	4.25	4.00	5.65	3.00	5.80
1899	2.00	7.00	3.00	4.50	4.00	6.00	3.75	7.25
1900	1.75	6.60	3.00	4.70	4.00	6.50	3.50	7.50
1901	2.10	7.00	2.90	5.05	4.75	8.25	3.50	7.25
1902	1.90	14.50	3.00	5.40	5.15	8.75	3.00	8.15
1903	1.50	8.35	2.25	4.40	5.00	6.00	2.65	5.75
1904	1.70	7.65	2.25	4.25	4.90	6.60	2.75	6.35
1905	1.85	7.00	2.35	4.75	5.15	7.10	3.05	6.50
1906	1.75	7.90	2.35	4.50	5.45	7.00	2.90	6.85
1907.								
January	2.00	7.30	4.60	5.40	6.10	6.55	3.10	6.10
February	2.00	7.25	4.40	5.25	5.75	6.10	3.20	5.85
March	2.00	6.90	4.65	5.50	6.00	6.25	3.25	5.80
April	2.50	6.75	4.75	5.70	5.85	6.25	3.80	5.85
May	2.20	6.50	4.65	5.60	5.90	6.05	3.75	6.10
June	2.25	7.10	4.75	5.75	6.00	6.85	4.25	6.75
July	2.00	7.50	5.00	5.90	6.90	7.25	3.25	7.10
August	2.00	7.60	4.90	6.00	6.65	7.35	3.35	7.30
September	2.00	7.35	5.00	5.65	6.65	7.00	5.25	7.10
October	2.00	7.45	4.85	5.50	6.70	7.00	4.25	7.05
November	2.00	7.25	4.10	5.00	5.35	6.60	3.50	6.40
December	2.00	8.00	4.15	5.15	5.40	6.75	3.15	5.70
Year	2.00	8.00	4.10	6.00	5.35	7.35	3.10	7.30
1908.								
January	2.00	6.40	3.25	4.50	5.50	5.80	2.75	5.75
February	2.00	6.25	3.25	4.50	5.70	5.80	2.25	5.55
March	2.25	7.35	3.50	5.00	5.75	7.15	3.10	7.00
April	2.50	7.40	4.00	5.50	6.90	7.35	3.00	7.00
May	2.50	7.40	3.90	5.25	7.00	7.20	3.00	7.05
June	2.50	8.40	4.00	5.25	7.15	8.25	3.00	8.05
July	2.30	8.25	3.50	5.00	7.45	8.00	3.50	8.10
August	2.25	7.90	3.15	4.75	6.75	7.50	2.75	7.00
September	2.10	7.85	2.75	4.25	6.75	7.75	3.25	7.50
October	2.00	7.60	2.65	4.25	6.85	7.50	3.30	7.25
November	2.25	8.00	3.00	4.40	7.10	7.60	3.00	7.25
December	2.30	8.00	3.25	4.75	6.90	8.00	2.50	6.80
Year	2.00	8.40	2.65	5.50	5.50	8.25	2.25	8.10
1909.								
January	2.90	7.50	3.60	5.00	5.70	7.00	4.00	7.25
February	3.00	7.15	3.85	4.75	6.15	6.75	4.00	6.25
March	3.05	7.40	3.85	5.00	6.75	7.00	4.00	6.95
April	3.15	7.15	3.85	4.90	6.75	7.00	4.50	6.75
May	3.30	7.30	4.00	5.25	6.60	7.00	4.75	7.00
June	3.15	7.25	3.75	5.50	7.00	7.15	5.00	7.00
July	3.10	7.45	3.50	5.25	7.00	7.40	5.25	7.25
August	3.00	8.00	3.35	5.25	7.10	7.65	4.50	7.50
September	3.00	8.50	3.25	5.00	7.50	8.50	4.75	8.00
October	3.05	9.10	3.00	4.85	8.00	8.75	4.50	8.00
November	3.05	9.25	3.25	4.85	7.25	8.25	3.75	8.25
December	3.00	9.50	3.50	5.10	6.40	10.50	3.75	8.25
Year	2.90	9.50	3.00	5.50	5.70	10.50	3.75	8.25
1910.								
January	2.90	8.40	3.35	5.00	6.75	7.50	3.75	7.50
February	3.00	8.10	3.35	5.25	6.75	7.35	3.75	7.40
March	3.25	8.85	4.50	6.25	7.50	8.50	4.75	8.25
April	3.50	8.75	4.35	6.50	8.00	8.35	5.50	8.00
May	4.25	8.75	4.00	6.25	7.75	8.50	5.50	8.15
June	3.00	8.85	3.75	6.00	8.20	8.60	5.00	8.25
July	3.00	8.60	3.65	5.75	8.00	8.25	4.75	8.25
August	3.15	8.50	3.00	5.35	7.85	8.25	4.75	8.00
September	3.15	8.50	3.10	5.25	7.50	7.90	4.50	8.00
October	3.00	8.20	3.00	4.90	7.25	8.00	4.25	7.50
November	3.00	7.75	3.25	4.65	6.80	7.35	3.75	7.25
December	3.00	7.55	3.65	4.85	6.35	7.75	3.75	6.75
Year	2.90	8.85	3.00	6.50	6.35	8.50	3.75	8.25

BUTTER.

Average price received by farmers on the first of months indicated.

State, Territory, or Division.	1909. Feb.	1909. Apr.	1909. June.	1909. Aug.	1909. Oct.	1909. Dec.	1910. Jan.	1910. Feb.	1910. Mar.	1910. Apr.	1910. May.	1910. June.	1910. July.	1910. Aug.	1910. Sept.	1910. Oct.	1910. Nov.	1910. Dec.	Mar., 1911.
	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.
Maine	27	27	28	28	32	32	33	31	30	30	30	30	27	28	29	30	31	31	29
New Hampshire	28	28	28	29	31	33	32	32	32	32	32	30	30	32	31	32	32	32	29
Vermont	30	29	28	28	31	32	32	33	33	30	31	29	29	28	31	31	31	31	28
Massachusetts	32	31	31	32	34	36	37	34	34	35	35	33	32	34	34	34	34	35	31
Rhode Island	32	31	31	31	34	37	35	36	35	35	35	35	31	35	36	35	34	34	30
Connecticut	32	32	30	32	34	34	34	34	35	34	33	35	34	33	33	35	35	34	31
New York	29	29	26	26	30	32	33	33	30	30	30	29	27	28	30	31	32	33	26
New Jersey	30	31	31	30	32	34	34	35	34	33	32	33	33	32	33	33	33	34	31
Pennsylvania	30	29	25	26	30	33	34	33	30	30	29	27	25	27	29	31	32	33	27
N. Atlantic	29.4	29.0	26.4	26.8	30.5	32.6	33.4	32.5	30.6	30.4	30.0	28.7	27.0	28.1	29.9	31.2	32.0	32.7	27.2
Delaware	25	27	26	28	28	29	28	28	28	28	24	23	23	24	28	28	28	31	28
Maryland	27	25	25	23	26	28	29	29	27	27	26	24	23	24	24	27	29	29	27
Virginia	23	24	22	21	24	25	26	26	26	25	26	23	22	23	23	24	26	26	24
West Virginia	25	24	21	20	23	25	27	27	25	25	24	23	21	22	23	24	25	27	24
North Carolina	22	22	22	22	23	24	25	24	25	24	24	23	22	23	22	23	25	24	22
South Carolina	24	24	22	22	23	24	25	25	24	25	25	24	25	24	25	25	26	26	25
Georgia	22	22	22	22	23	24	25	25	24	24	24	24	24	24	24	24	25	27	24
Florida	33	30	30	29	30	32	32	31	32	32	32	30	29	29	29	29	27	31	29
S. Atlantic	23.7	23.5	22.2	21.6	23.7	25.0	26.1	25.9	25.5	25.0	24.8	23.4	22.6	23.3	23.4	24.3	25.8	26.4	24.1
Ohio	25	24	21	22	24	27	28	28	26	25	25	23	22	22	24	26	27	28	21
Indiana	22	22	21	21	22	25	26	26	24	24	23	22	21	21	23	24	25	25	20
Illinois	24	24	22	21	24	26	28	27	26	25	24	23	22	23	24	25	26	27	21
Michigan	25	24	22	22	25	28	29	28	26	26	26	24	23	23	26	27	28	28	22
Wisconsin	28	28	25	25	27	30	32	31	29	29	29	27	27	27	28	29	29	30	24
N.C.E.Miss.R.	24.8	24.3	22.0	22.1	24.3	27.1	28.5	27.9	25.8	25.7	25.3	23.7	22.8	23.0	24.9	26.1	27.0	27.6	21.5
Minnesota	26	25	24	24	26	29	31	29	28	27	27	26	25	26	27	28	28	29	22
Iowa	26	25	23	22	25	28	30	29	28	27	26	24	24	25	26	26	27	27	21
Missouri	21	21	19	18	21	23	24	23	23	22	22	20	20	20	21	22	22	24	18
North Dakota	24	21	21	21	24	27	28	28	26	24	23	23	22	22	24	25	25	26	21
South Dakota	24	21	20	20	22	27	29	28	25	23	24	22	22	23	24	25	26	27	21
Nebraska	23	20	20	20	22	26	28	26	24	23	22	21	21	21	22	24	25	26	17
Kansas	24	21	20	20	23	26	27	26	24	23	23	21	21	21	23	23	24	25	18
N.C.W.Miss.R.	24.1	22.5	21.3	20.8	23.5	26.6	28.2	26.9	25.3	24.5	24.1	22.5	22.3	22.8	24.0	24.7	25.3	26.3	19.6
Kentucky	20	20	19	18	19	21	23	23	22	22	22	20	19	19	20	20	21	22	19
Tennessee	19	18	17	18	19	20	21	21	21	20	20	19	19	18	19	19	21	21	19
Alabama	20	20	19	19	20	22	21	21	20	21	20	20	20	21	20	20	21	23	20
Mississippi	22	21	21	21	21	23	24	23	23	22	22	21	21	22	22	22	23	23	23
Louisiana	26	25	25	25	25	26	26	26	28	26	25	26	25	25	25	24	25	26	26
Texas	21	20	20	20	22	23	26	24	23	22	23	21	20	21	22	24	25	25	21
Oklahoma	24	21	20	20	24	25	28	26	24	23	22	21	20	21	21	24	24	26	20
Arkansas	22	20	19	18	20	22	23	23	22	22	21	21	21	20	21	22	22	24	22
S. Central	21.0	20.0	19.4	19.3	20.7	22.2	23.8	23.1	22.3	21.8	21.7	20.6	20.0	20.3	20.9	21.7	22.7	23.5	20.7
Montana	33	30	31	29	34	35	36	38	37	34	33	33	30	34	33	35	35	37	35
Wyoming	30	28	28	27	31	33	36	33	36	30	31	29	27	33	30	30	33	32	29
Colorado	29	29	27	26	29	31	34	32	31	29	28	28	28	29	31	31	33	32	27
New Mexico	31	32	30	31	31	32	34	35	32	33	31	31	30	29	29	31	31	33	31
Arizona	38	35	33	34	33	37	41	40	36	39	38	36	34	37	36	34	38	40	35
Utah	28	28	28	28	33	32	33	32	28	30	29	29	30	31	30	31	31	32	28
Nevada	30	35	35	34	34	34	35	35	34	40	32	31	32	35	34	40	37	37	38
Idaho	31	30	26	27	30	34	34	37	34	33	31	28	30	31	34	34	35	34	32
Washington	35	33	27	29	35	37	39	39	37	35	31	30	31	32	33	34	36	37	31
Oregon	30	32	30	28	32	34	35	33	35	34	30	30	30	30	32	35	35	37	34
California	31	29	26	27	31	36	35	33	32	30	28	28	28	28	31	33	34	36	31
Far Western	31.1	30.2	27.5	27.6	31.8	34.8	35.4	34.1	33.3	31.8	29.3	29.0	29.1	29.8	31.6	33.4	34.3	35.5	31.2
United States	25.1	24.2	22.5	22.4	25.0	27.4	[illegible]	27.9	26.3	25.8	25.5	24.1	23.3	23.8	25.2	26.2	27.1	27.8	22.7

BUTTER—Continued.

International trade in butter, 1905–1909.[a]

EXPORTS.

Country.	Year beginning—	1905.	1906.	1907.	1908.	1909.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Argentina	Jan. 1	11,890,040	9,712,076	6,691,980	7,825,681	8,802,359
Australia	Jan. 1	55,904,151	75,765,536	66,076,915	51,193,311	55,644,925
Austria-Hungary	Jan. 1	8,944,151	9,501,920	5,456,880	8,217,949	3,913,165
Belgium	Jan. 1	3,800,594	3,704,232	3,755,227	3,821,565	3,998,906
Canada	Jan. 1	34,806,671	21,680,489	4,835,497	5,994,144	4,375,004
Denmark	Jan. 1	176,081,731	175,043,639	188,829,579	196,061,115	196,692,759
Finland	Jan. 1	35,135,901	33,192,114	28,024,833	26,525,880	25,644,456
France	Jan. 1	49,781,584	39,307,326	34,648,529	43,951,344	51,263,343
Germany [b]	Jan. 1	1,834,907	953,058	535,062	480,167	450,179
Italy	Jan. 1	13,359,789	10,746,430	7,835,006	8,602,656	8,028,051
Netherlands	Jan. 1	51,162,980	56,404,861	64,809,205	72,911,951	68,686,019
New Zealand	Jan. 1	34,240,864	35,865,200	36,785,392	25,756,752	35,964,096
Norway	Jan. 1	3,612,714	3,281,403	2,864,267	3,432,508	3,446,165
Russia	Jan. 1	86,966,484	115,972,393	132,113,551	112,789,519	[c] 124,805,837
Sweden	Jan. 1	40,636,298	35,712,817	38,227,303	40,030,708	42,362,456
United States	Jan. 1	16,194,483	24,468,023	3,857,288	8,918,091	2,925,730
Other countries	....	3,637,216	3,802,267	3,089,024	3,223,000	[c] 3,011,000
Total	....	627,990,558	655,113,784	628,435,538	619,736,341	640,014,450

IMPORTS.

Country.	Year beginning—	1905.	1906.	1907.	1908.	1909.
Australia	Jan. 1	592,201	70,143	20,885	40,874	80,111
Belgium	Jan. 1	10,054,979	11,128,520	12,529,438	10,998,273	12,718,269
Brazil	Jan. 1	6,567,718	5,344,412	5,451,126	4,122,650	[d] 4,122,650
British South Africa [e]	Jan. 1	12,125,157	11,273,748	7,533,108	7,445,086	4,512,895
Denmark	Jan. 1	12,566,345	13,049,158	8,429,437	4,376,175	6,728,836
Dutch East Indies	Jan. 1	2,957,073	3,433,031	3,807,470	3,239,267	[c] 3,406,187
Egypt	Jan. 1	3,066,949	2,958,784	3,521,070	2,970,514	2,480,303
France	Jan. 1	10,066,650	11,402,808	14,671,596	12,374,543	10,748,748
Germany [b]	Jan. 1	79,524,904	80,896,179	85,565,569	74,623,809	97,130,708
Netherlands	Jan. 1	5,439,836	5,630,865	3,332,634	2,396,806	4,238,072
Russia	Jan. 1	1,103,318	1,914,484	781,842	914,954	[c] 541,692
Sweden	Jan. 1	911,993	1,316,117	1,498,453	275,628	398,499
Switzerland	Jan. 1	11,955,445	7,732,271	7,914,152	8,211,776	9,283,130
United Kingdom	Jan. 1	456,662,976	477,092,448	462,175,280	465,443,216	446,935,664
Other countries	....	17,458,643	17,973,778	21,233,001	17,313,000	[c] 21,727,000
Total	....	631,054,187	651,216,746	638,465,061	614,746,571	625,052,764

[a] See "General note," p. 507.
[b] Not including free ports prior to March 1, 1906.
[c] Preliminary.
[d] Year preceding.
[e] Cape Colony, Natal, and Transvaal before 1906.

CHEESE.

International trade in cheese, 1905–1909.[a]

EXPORTS.

Country.	Year beginning—	1905.	1906.	1907.	1908.	1909.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Bulgaria	Jan. 1	7,227,827	6,606,741	5,674,170	5,598,139	5,218,136
Canada	Jan. 1	219,881,232	213,316,430	189,381,875	172,081,891	177,259,042
France	Jan. 1	22,125,152	22,058,487	25,584,535	24,272,447	26,103,125
Germany [b]	Jan. 1	2,650,397	2,629,673	2,891,803	3,387,843	2,381,409
Italy	Jan. 1	37,696,611	42,314,633	46,607,032	43,711,481	44,054,742
Netherlands	Jan. 1	98,438,575	104,742,665	113,648,000	118,253,711	124,070,366
New Zealand	Jan. 1	9,918,944	14,695,072	26,525,296	31,449,376	44,867,984
Russia	Jan. 1	1,382,181	1,796,576	1,468,094	3,758,259	[c] 4,517,711
Switzerland	Jan. 1	61,383,731	61,935,107	62,213,331	67,654,558	69,217,606
United States	Jan. 1	8,229,756	22,376,340	10,341,335	10,190,843	3,501,214
Other countries		7,503,508	8,359,652	8,335,667	8,295,000	[c] 8,428,000
Total		476,437,914	500,831,376	492,671,138	488,653,548	509,619,335

IMPORTS.

Country.	Year beginning—	1905.	1906.	1907.	1908.	1909.
Argentina	Jan. 1	4,234,616	7,304,669	7,304,669	8,085,698	8,884,664
Australia	Jan. 1	384,718	304,951	299,711	566,808	367,504
Austria-Hungary	Jan. 1	9,358,179	8,950,545	9,118,758	9,748,838	10,483,755
Belgium	Jan. 1	28,488,857	30,333,690	32,278,995	31,051,362	30,523,564
Brazil	Jan. 1	3,120,168	3,784,774	3,632,090	3,455,121	[d] 3,455,121
British South Africa [e]	Jan. 1	3,249,035	5,752,252	4,761,140	4,459,453	4,329,228
Cuba	Jan. 1	4,202,427	4,078,517	5,232,438	4,147,120	4,106,693
Denmark	Jan. 1	1,932,351	1,782,437	1,784,642	1,686,536	1,739,429
Egypt	Jan. 1	9,512,371	10,064,909	8,650,855	9,072,778	8,947,118
France	Jan. 1	43,254,168	44,714,972	46,137,701	50,011,189	47,420,285
Germany [b]	Jan. 1	44,698,270	48,187,525	44,760,881	45,689,689	46,292,191
Italy	Jan. 1	9,921,901	10,398,982	10,294,042	16,953,323	17,438,827
Russia	Jan. 1	2,914,736	3,179,913	3,463,940	3,437,180	[c] 3,214,039
Spain	Jan. 1	3,901,938	4,255,835	4,398,856	4,531,113	4,422,370
Switzerland	Jan. 1	5,530,515	5,541,979	7,048,617	6,564,703	6,041,045
United Kingdom	Jan. 1	267,722,560	289,371,824	259,833,392	251,908,608	261,227,232
United States	Jan. 1	25,731,604	29,975,017	34,238,459	33,793,726	37,795,506
Other countries		19,021,937	21,271,863	20,753,857	19,751,000	[c] 22,097,000
Total		487,180,351	529,254,654	503,993,043	504,914,245	518,785,571

[a] See "General note," p. 507.
[b] Not including free ports prior to March 1, 1906.
[c] Preliminary.
[d] Year preceding.
[e] Cape Colony before 1906.

SHEEP AND WOOL.

Number and farm value of sheep on farms in the United States, 1867–1911.

Year.	Number.	Price per head Jan. 1.	Farm value Jan. 1.	Year.	Number.	Price per head Jan. 1.	Farm value Jan. 1.
1867	39,385,000	$2.50	$98,644,000	1890	$44,336,000	$2.27	$100,660,000
1868	38,992,000	1.82	71,053,000	1891	43,431,000	2.50	108,397,000
1869	37,724,000	1.64	62,037,000	1892	44,938,000	2.58	116,121,000
1870	40,853,000	1.96	79,876,000	1893	47,274,000	2.66	125,909,000
1871	31,851,000	2.14	68,310,000	1894	45,048,000	1.98	89,186,000
1872	31,679,000	2.61	82,768,000	1895	42,294,000	1.58	66,686,000
1873	33,002,000	2.71	89,427,000	1896	38,299,000	1.70	65,168,000
1874	33,938,000	2.43	82,353,000	1897	36,819,000	1.82	67,021,000
1875	33,784,000	2.55	86,278,000	1898	37,657,000	2.46	92,721,000
1876	35,935,000	2.37	85,121,000	1899	39,114,000	2.75	107,698,000
1877	35,804,000	2.13	76,362,000	1900	41,883,000	2.93	122,666,000
1878	35,740,000	2.21	78,898,000	1901	59,757,000	2.98	178,072,000
1879	38,124,000	2.07	78,965,000	1902	62,039,000	2.65	164,446,000
1880	40,766,000	2.21	90,231,000	1903	63,965,000	2.63	168,316,000
1881	43,570,000	2.39	104,071,000	1904	51,630,000	2.59	133,530,000
1882	45,016,000	2.37	106,596,000	1905	45,170,000	2.82	127,332,000
1883	49,237,000	2.53	124,366,000	1906	50,632,000	3.54	179,056,000
1884	50,627,000	2.37	119,903,000	1907	53,240,000	3.84	204,210,000
1885	50,360,000	2.14	107,961,000	1908	54,631,000	3.88	211,736,000
1886	48,322,000	1.91	92,444,000	1909	56,084,000	3.43	192,632,000
1887	44,759,000	2.01	89,873,000	1910	57,216,000	4.08	233,664,000
1888	43,545,000	2.05	89,280,000	1911		3.73	
1889	42,599,000	2.13	90,640,000				

Imports, exports, and average prices of sheep, 1892–1910.

Year ending June 30—	Imports.			Exports.		
	Number.	Value.	Average import price.	Number.	Value.	Average export price.
1892	380,814	$1,440,530	$3.78	46,960	$161,105	$3.43
1893	459,484	1,682,977	3.66	37,260	126,394	3.39
1894	242,568	788,181	3.25	132,370	832,763	6.29
1895	291,461	682,618	2.34	405,748	2,630,686	6.48
1896	322,692	853,530	2.65	491,565	3,076,384	6.26
1897	405,633	1,019,668	2.51	244,120	1,531,645	6.27
1898	392,314	1,106,322	2.82	199,690	1,213,886	6.08
1899	345,911	1,200,081	3.47	143,286	853,555	5.96
1900	381,792	1,365,026	3.58	125,772	733,477	5.83
1901	331,488	1,236,277	3.73	297,925	1,933,000	6.49
1902	266,953	956,710	3.58	358,720	1,940,060	5.41
1903	301,623	1,036,934	3.44	176,961	1,067,860	6.03
1904	238,094	815,289	3.42	301,313	1,954,604	6.49
1905	186,942	704,721	3.77	268,365	1,687,321	6.29
1906	240,747	1,020,359	4.24	142,690	804,090	5.64
1907	224,798	1,120,425	4.98	135,344	750,242	5.54
1908	224,765	1,082,606	4.82	101,000	589,285	5.83
1909	102,663	502,640	4.90	67,656	365,155	5.40
1910	126,152	696,879	5.52	44,517	209,000	4.69

SHEEP AND WOOL—Continued.

Wholesale prices of sheep per 100 pounds, 1897–1910.

Date.	Chicago.		Cincinnati.		St. Louis.		Omaha.	
	Inferior to choice.		Good to extra.		Good to choice natives.		Native.	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.
1897	$2.00	$5.00	$2.75	$5.00	$2.00	$4.00	$1.75	$5.25
1898	2.50	5.25	3.10	4.75	3.00	5.00	2.75	5.25
1899	2.50	5.65	3.00	5.00	3.00	5.60	2.75	5.50
1900	2.00	6.50	1.25	6.00	3.40	6.25	2.00	6.10
1901	2.50	5.15	2.10	5.00	3.00	5.10	2.00	5.00
1902	1.25	6.50	2.50	5.75	3.65	6.35	2.00	6.25
1903	1.25	7.00	2.60	6.25	3.50	6.25	3.00	6.75
1904	1.50	6.00	2.75	4.60	3.75	5.65	2.25	5.90
1905	3.80	6.30	3.60	5.50	4.60	6.35	2.50	6.90
1906	3.00	7.00	3.85	5.75	5.00	6.45	2.75	6.50
1907.								
January	2.25	6.00	4.25	4.65	5.50	6.00	3.50	6.30
February	2.75	6.00	4.50	5.10	5.60	5.85	3.75	6.45
March	3.00	6.50	4.75	5.25	5.65	5.85	3.00	6.50
April	3.50	7.25	5.50	5.90	6.00	6.75	4.00	7.75
May	3.50	7.00	4.75	5.15	6.10	6.50	4.40	6.75
June	3.00	7.00	4.50	4.90	5.85	7.00	4.50	6.75
July	3.25	6.15	4.10	4.65	5.60	5.85	4.00	6.25
August	3.00	6.00	4.55	5.15	5.50	5.75	3.50	6.50
September	3.00	6.00	4.35	4.90	5.50	6.10	3.75	4.65
October	2.00	5.75	4.35	4.90	5.35	5.65	4.00	5.50
November	2.00	5.25	3.85	4.60	5.25	5.35	3.75	5.20
December	2.00	5.25	3.65	4.40	4.25	4.75	3.00	5.00
Year	2.00	7.25	3.65	5.90	4.25	7.00	3.00	7.75
1908.							Western.	
January	2.50	5.75	4.25	5.00	5.00	5.50	3.00	6.10
February	2.50	5.75	4.50	5.25	4.25	6.35	3.50	6.00
March	3.25	7.00	4.65	5.50	5.25	6.50	4.00	7.40
April	3.00	7.00	4.50	5.25	6.50	6.90	3.50	6.70
May	2.00	6.75	4.10	5.00	4.75	5.90	3.00	6.00
June	2.50	5.60	3.60	4.50	5.00	5.50	2.25	6.10
July	2.50	5.25	3.00	3.85	4.40	4.50	2.00	4.50
August	2.25	5.50	3.25	4.00	4.25	4.65	1.25	4.25
September	2.00	5.15	2.75	3.75	4.15	4.35	1.25	4.10
October	2.00	5.25	3.00	3.75	4.10	4.65	1.25	4.75
November	2.00	5.50	3.00	3.75	4.50	4.65	1.25	4.75
December	2.00	5.50	3.25	4.25	4.50	4.75	2.00	5.50
Year	2.00	7.00	2.75	5.50	4.10	6.90	1.25	7.40
1909.								
January	2.50	5.50	3.50	5.25	4.25	6.00	2.00	5.75
February	2.00	5.50	4.50	5.25	5.40	6.25	3.00	5.35
March	3.00	5.75	4.50	5.75	5.50	6.50	3.50	6.50
April	3.50	6.50	4.75	5.75	6.15	6.50	5.25	6.70
May	3.00	6.90	4.35	5.25	6.35	6.65	5.00	6.70
June	2.50	6.75	3.50	5.25	5.25	6.50	4.00	6.50
July	2.50	5.50	3.35	4.50	4.25	5.00	3.50	5.25
August	2.00	5.00	3.75	4.50	4.50	5.00	3.65	4.85
September	2.00	5.25	3.50	4.50	4.50	5.00	3.65	4.90
October	2.00	5.00	3.35	4.25	4.75	5.00	3.70	4.75
November	2.00	5.50	3.60	4.50	4.35	5.00	3.75	5.35
December	2.50	6.00	3.75	5.50	5.15	6.25	3.90	6.00
Year	2.00	6.90	3.35	5.75	4.25	6.65	2.00	6.70
1910.								
January	3.25	6.30	4.75	6.00	6.00	6.30	4.00	6.10
February	4.00	7.90	5.25	6.50	6.10	7.25	4.00	7.35
March	5.00	9.30	6.00	6.75	7.00	8.50	5.25	8.25
April	4.00	8.40	6.00	7.00	8.00	8.75	6.50	8.00
May	4.25	7.65	4.50	6.50	5.75	8.30	4.25	7.85
June	3.75	6.25	3.60	5.25	5.00	6.00	3.50	6.25
July	2.50	5.00	3.00	4.25	4.25	4.60	3.00	4.55
August	3.00	4.65	3.25	4.25	4.25	4.50	2.90	4.50
September	3.00	4.65	3.25	4.25	4.35	4.75	2.10	4.60
October	2.75	4.45	3.15	4.25	4.25	4.50	2.45	4.25
November	2.00	4.50	3.00	4.15	3.75	4.20	2.00	4.15
December	2.85	4.50	3.25	4.00	4.10	4.25	2.25	4.15
Year	2.00	9.30	3.00	7.00	3.75	8.75	2.00	8.25

SHEEP AND WOOL—Continued.

Wool product of the United States in 1910, by States.

[Estimate of National Association of Wool Manufacturers.]

State or Territory.	Number of sheep of shearing age Apr. 1, 1910.	Average weight of fleece, 1910.	Per cent of shrinkage, 1910.	Wool, washed and unwashed.	Wool, scoured.
		Pounds.		*Pounds.*	*Pounds.*
Maine	210,000	6	40	1,260,000	756,000
New Hampshire	70,000	6	50	420,000	210,000
Vermont	180,000	6.5	51	1,170,000	573,300
Massachusetts	35,000	6.2	42	217,000	125,860
Rhode Island	7,500	5.3	42	39,750	23,055
Connecticut	35,000	5.25	42	183,750	106,575
New York	825,000	6	48	4,950,000	2,574,000
New Jersey	50,000	5.5	47	275,000	145,750
Pennsylvania	1,050,000	6	48	6,300,000	3,276,000
Delaware	7,000	5.5	45	38,500	21,175
Maryland	130,000	5.2	43	676,000	385,320
Virginia	365,000	4.5	37	1,642,500	1,034,775
West Virginia	600,000	5.75	49	3,450,000	1,759,500
North Carolina	204,000	3.75	42	765,000	443,700
South Carolina	50,000	3.75	42	187,500	108,750
Georgia	225,000	3	40	675,000	405,000
Florida	115,000	3.25	40	373,750	224,250
Ohio	2,600,000	6.5	51	16,900,000	8,281,000
Indiana	900,000	6.5	45	5,850,000	3,217,500
Illinois	700,000	7	50	4,900,000	2,450,000
Michigan	1,700,000	6.75	50	11,475,000	5,737,500
Wisconsin	900,000	6.75	47	6,075,000	3,219,750
Minnesota	375,000	6.8	48	2,550,000	1,326,000
Iowa	800,000	6.75	48	5,400,000	2,808,000
Missouri	860,000	7	47	6,020,000	3,190,600
North Dakota	270,000	6.5	60	1,755,000	702,000
South Dakota	625,000	6.5	60	4,062,500	1,625,000
Nebraska	250,000	6.5	60	1,625,000	650,000
Kansas	175,000	7.5	64	1,312,500	472,500
Kentucky	800,000	4.75	38	3,800,000	2,356,000
Tennessee	291,000	4.25	40	1,236,750	742,050
Alabama	160,000	3.5	40	560,000	336,000
Mississippi	150,000	4	42	600,000	348,000
Louisiana	155,000	3.7	41	573,500	338,365
Texas	1,325,000	6.75	67	8,943,750	2,951,438
Oklahoma	80,000	6.5	67	520,000	171,600
Arkansas	200,000	4	40	800,000	480,000
Montana	4,800,000	7	64	33,600,000	12,096,000
Wyoming	4,650,000	7.75	68	36,037,500	11,532,000
Colorado	1,400,000	6.5	65	9,100,000	3,185,000
New Mexico	3,200,000	6	65	19,200,000	6,720,000
Arizona	825,000	6	65	4,950,000	1,732,500
Utah	2,100,000	6.75	66	14,175,000	4,819,500
Nevada	850,000	7	68	5,950,000	1,904,000
Idaho	2,600,000	7.3	65	18,980,000	6,643,000
Washington	450,000	9	69	4,050,000	1,255,500
Oregon	1,750,000	8.25	68	14,437,500	4,620,000
California	1,900,000	7	66	13,300,000	4,522,000
United States	41,999,500	6.7	60	281,362,750	112,605,813
Pulled wool			27	40,000,000	29,200,000
Total product 1910				321,362,750	141,805,813

SHEEP AND WOOL—Continued.

Range of prices of wool per pound in Boston, 1897–1910.[a]

Date.	Ohio fine, unwashed.		Indiana quarter-blood, unwashed.		Ohio XX, washed.		Ohio No. 1, washed.		Ohio Delaine, washed.		Michigan fine, unwashed.[b]		Fine selected Territory, staple scoured.		Fine medium Territory, clothing scoured.		Texas, 12 months, scoured.		Fine free fall, Texas or California, scoured.		Pulled, A super, scoured.		Pulled, B super, scoured.	
	Low	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.
	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.
1897	13½	21	16½	24	19	30	21	30	20	30	16½	24	36	58	30	52	33	55	26	45	31	48	28	43
1898	18	21	20	24	27	30	29	31	28	32	21	25	46	57	42	52	42	53	35	45	40	48	32	43
1899	16	26	20	28	25½	38	28½	39	27	40	20	30	42	75	38	62	40	65	30	52	40	57	30	52
1900	18	26	23	29	27	38	28	39	27½	40	21½	29	49	74	45	62	48	65	40	55	42	57	37	50
1901	16½	19½	19½	24	26	28	25	29	27½	30	20	22	43	50	35	44	43	50	36	42	35	45	30	38
1902	19	23	20½	24	27	32	26	31	28	35	21	27	48	59	42	50	48	60	38	48	38	46	33	40
1903	20	25	22	25	30	35	29	34	33½	37	21	27½	52	60	50	58	53	60	44	48	40	47	39	44
1904	21	25	24	33	32	36	30	40	34	38	19	22	50	70	50	68	52	68	44	56	43	60	40	55
1905	23	30	30	37	34	37	36	43	36	40	20	27	65	78	60	72	63	76	54	63	55	65	52	60
1906	24	28	30	34	33½	36	37	41	35½	37½	24	26½	70	78	65	70	72	76	58	63	53	69	47	56
1907.																								
January	25	27	32	34	34	34½	40	41	37	38	24	25	72	75	66	70	72	75	60	62	56	58	46	52
February	26	27	32	34	34	34½	40	41	37	38	25	25	72	75	68	70	73	75	60	62	56	60	47	52
March	26	27	31	33	34	34½	39	40	37	38	25	25	72	73	68	73	72	75	58	60	53	60	45	52
April	26	27	31	33	34	34½	39	40	37	38	24	25	72	73	68	70	72	74	58	60	53	58	45	50
May	25	27	30	33	33	34½	38	40	36	38	24	25	70	73	68	70	72	74	57	60	53	58	45	50
June	25	26	30	31	33	34	38	39	36	37½	23	24	70	73	68	70	70	73	57	58	53	58	43	47
July	25	28	30	31	33	34	38	39	37	38	24	25	72	73	68	70	72	73	57	58	53	58	44	47
August	26	27	29	31	34	35	39	40	38	39	24	26	72	75	68	72	72	73	57	58	55	58	43	47
September	27	27	29	31	34	35	39	40	38	39	25	26	72	73	70	72	72	73	57	58	52	58	43	45
October	27	27	29	30	34	35	39	40	38	39	24	26	72	73	70	72	72	73	57	58	52	57	43	45
November	26	27	29	30	34	35	39	40	38	39	24	25	72	73	70	72	72	73	52	58	50	57	42	45
December	26	27	29	30	34	35	39	40	38	39	24	25	70	73	68	72	72	73	50	55	45	55	38	45
Year	25	28	29	34	33	35	38	41	36	39	23	26	70	75	66	73	70	75	50	62	45	60	38	52
1908.																								
January	26	27	28	30	34	35	38	40	38	39	24	25	70	72	58	62	70	72	50	53	46	55	38	45
February	24	27	26	30	33	34	37	39	37	38	22	25	65	70	53	57	68	70	48	52	45	48	35	40
March	24	26	25	28	33	34	37	38	37	38	22	24	63	68	53	55	63	65	48	50	44	48	35	40
April	22	25	23	26	32	34	35	38	35	37	21	23	58	65	48	55	56	65	43	48	44	48	35	40
May	19	21	20	24	30	32	31	35	31	34	18	20	54	60	43	48	50	56	42	45	44	48	32	38
June	19	20	20	24	30	32	31	32	31	34	18	20	53	57	43	48	50	52	42	43	44	45	32	37
July	21	23	23	25	32	33	32	35	33	36	20	22	55	60	45	48	50	55	42	43	44	46	32	38
August	20	23	24	25	32	33	34	35	35	36	20	22	57	60	45	48	52	53	42	43	43	45	35	38
September	20	22	23	24	32	33	34	35	34	36	19	21	57	58	43	45	50	53	42	43	42	45	35	38
October	21	22	23	25	32	33	34	35	34	35	20	21	57	60	45	50	50	54	42	43	42	48	35	40

November	21	22	24	27	32½	33	34	35	34	36	20	21	57	63	47	52	51	60	42	50	43	50	36	45
December	21	24	25	27	32½	35	34	39	35	37	20	22	62	65	49	52	60	62	45	47	47	55	39	45
Year	19	27	20	30	30	35	31	40	31	39	18	25	53	72	43	62	50	72	42	53	42	55	32	45
1909.																								
January	23	24	27	28	34	35	38	39	37	40	22	23	62	65	60	62	60	65	48	50	47	55	38	48
February	23	24	27	29	34	35	38	39	38	40	22	23	62	65	60	62	62	65	48	50	50	55	40	48
March	23	24	27	29	34	35	38	39	38	40	22	23	63	65	60	62	62	65	48	50	50	55	40	48
April	23	24	27	29	34	35	38	39	39	40	22	23	63	65	60	62	62	65	45	47	50	56	40	48
May	23	28	28	37	34	35	38	40	39	42	23	25	63	77	60	72	62	67	45	55	55	60	46	53
June	27	28	36	37	35	36	40	41	40	42	25	26	74	78	69	72	70	72	58	60	55	62	48	53
July	27	28	32	37	35	36	40	41	40	42	25	26	74	78	69	72	70	75	58	60	55	62	48	53
August	27	28	32	33	35	36	40	41	39	40	25	26	75	80	69	72	73	78	58	60	55	62	48	55
September	27	28	32	33	35	37	40	41	39	41	25	26	77	80	70	72	75	78	58	60	55	63	50	58
October	27	28	32	33	36	37	40	41	40	41	25	26	77	80	70	72	75	78	58	60	60	64	52	58
November	27	28	32	33	37	38	40	41	39	41	25	26	77	80	70	72	75	78	58	60	60	64	52	58
December	27	28	32	33	37	38	40	41	39	40	25	26	77	80	70	72	73	78	58	62	60	65	52	58
Year	23	28	27	37	34	38	38	41	37	42	22	26	62	80	60	72	60	78	45	62	47	65	38	58
1910.							(c)												(d)					
January	27	28	32	33	37	38	40	41	39	40	25	26	75	80	64	68	73	75	60	62	60	65	52	58
February	27	28	32	36	37	38	40	41	39	40	25	26	75	76	64	68	70	75	60	62	60	65	52	58
March	25	28	34	36	36	38	40	41	37	40	24	26	70	75	63	68	68	71	60	62	60	65	52	58
April	23	26	29	35	33	37	36	41	35	38	22	25	63	72	57	65	65	70	52	60	57	63	48	58
May	23	24	28	30	33	34	36	37	35	35	22	23	63	66	55	58	60	67	52	54	56	58	48	54
June	20	24	26	28	32	34	36	37	34	35	22	23	63	65	56	58	60	61	52	54	56	58	48	52
July	20	21	24	26	30	32	27	29	34	34	19	20	60	64	54	56	55	60	48	52	56	57	45	51
August	20	21	24	28	30	30	28	29	34	34	19	20	60	65	55	57	55	60	48	50	56	62	45	48
September	20	23	27	28	30	30	28	29	34	34	19	21	64	65	55	58	57	62	50	50	56	57	45	48
October	21	23	27	28	30	30	28	30	34	34	19	21	64	65	55	56	57	60	50	50	52	57	45	48
November	22	23	27	28	30	32	29	30	34	34	19	21	64	66	55	56	58	60	48	50	50	55	45	52
December	22	24	27	28	31	32	29	30	34	35	20	21	63	65	55	56	58	60	48	50	53	55	47	52
Year	20	28	24	36	30	38	27	41	34	40	19	26	60	80	54	68	55	75	48	62	50	65	45	58

a From Commercial Bulletin, Boston.
b Quoted as X, washed, to June, 1903.
c From July to December, inclusive, quotations are for Ohio half blood, unwashed, approximately 7 cents lower than Ohio No 1.
d Excluding California.

SHEEP AND WOOL—Continued.

Wholesale prices of wool per pound, 1897–1910.

Date.	Boston. Ohio XX, washed. Low.	Boston. Ohio XX, washed. High.	Philadelphia. Ohio XX, washed. Low.	Philadelphia. Ohio XX, washed. High.	St. Louis. Best tub-washed. Low.	St. Louis. Best tub-washed. High.
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
1897	19	30	19	31	20½	32
1898	27	30	28	31	25½	30
1899	25½	38	25½	36	25½	35
1900	27	38	27	37	28	36
1901	26	28	25	28	24	29½
1902	27	32	26	32	24	29
1903	30	35	30	34	27	31
1904	32	36	31½	33½	30½	41
1905	34	37	34	36	37	43
1906	33½	36	33	35	31	40
1907.						
January	34	34½	33½	34	38	38
February	34	34½	33½	34	38	38
March	34	34½	33½	34	37	38
April	34	34½	33½	34	36	38
May	33	34½	33½	34	36	37
June	33	34	33	34	36	37½
July	33	34	33	34	36	36½
August	34	35	33	34	36	36½
September	34	35	33	34	35	36
October	34	35	33	34	36	36
November	34	35	33	34	33	35
December	34	35	33	34	33	33
Year	33	35	33	34	33	38
1908.						
January	34	35	33	34	33	33
February	33	34	33	33½	33	33
March	33	34	32½	33	30	33
April	32	34	32	32½	24	30
May	30	32	31	32	22	25
June	30	32	30	31	25	27½
July	32	33	31	32	27	27
August	32	33	32	33	27	27
September	32	33	32	33	26	27
October	32	33	32	33	26	27
November	32½	33	32	33	26	29
December	32½	35	33	33½	28	30
Year	30	35	30	34	22	33
1909.						
January	34	35	32	33	30	31
February	34	35	32	33	31	32
March	34	35	32	33	31	32
April	34	35	33	34	31	32
May	34	35	34	35	32	38
June	35	36	34	35	36	38
July	35	36	34	35	36	36½
August	35	36	34	35	36	37½
September	35	37	34	35	37	37½
October	36	37	34	35	37	38
November	37	38	34	35	38	38
December	37	38	34	35	37	38
Year	34	38	32	35	30	38
1910.						
January	37	38	34	35	37	37
February	37	38	34	35	37	37
March	36	38	34	35	36	37
April	33	37	33	35	36	36
May	33	34	32	34	33	36
June	32	34	31	33	31	33
July	30	32	30	32	32	33
August	30	30	30	31	33	33
September	30	30	30	31	33	33
October	30	30	30	31	33	33
November	30	32	30	31	33	33
December	31	32	30	31	33	33
Year	30	38	30	35	31	37

SHEEP AND WOOL—Continued.

International trade in wool, 1905–1909.[a]

EXPORTS.

Country.	Year beginning—	1905.	1906.	1907.	1908.	1909.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Algeria	Jan. 1	22,501,034	33,486.857	26,624,118	16,233,514	[b] 30,228,338
Argentina	Jan. 1	421,098,234	328,731,186	341,297,532	386,994,937	389,513,137
Australia	Jan. 1	437,167,965	523,026,207	637,836,589	598,032,199	663,444,284
Belgium	Jan. 1	40,023,199	40,098,225	40,778,437	40,465,085	40,651,742
British India	Jan. 1	39,212,655	44,870,964	44,194,774	32,108,670	63,052,315
British South Africa[c]	Jan. 1	74,311,616	104,516,265	116,472,023	122,443,992	150,630,571
Chile	Jan. 1	20,753,848	28,978,611	31,762,088	32,430,184	37,908,811
China	Jan. 1	46,404,400	46,205,733	39,429,333	33,441,467	50,057,733
France	Jan. 1	72,227,925	79,511,478	84,639,488	72,337,175	91,793,812
Netherlands	Jan. 1	30,778,915	28,099,091	20,296,466	26,359,444	27,520,247
New Zealand	Jan. 1	145,257,159	159,849,207	177,535,594	168,035,607	205,913,501
Peru	Jan. 1	9,944,067	10,066,289	8,406,261	[d] 8,406,261	[e] 8,406,261
Russia	Jan. 1	32,423,264	41,919,341	30,351,617	14,409,079	[b] 28,799,958
Spain	Jan. 1	43,825,033	26,552,450	32,203,800	14,373,068	36,906,860
Turkey	Mar. 14	40,156,583	[f] 40,156,583	[f] 40,156,583	[f] 40,156,583	[f] 40,156,583
United Kingdom	Jan. 1	35,251,500	29,808,700	31,148,692	38,311,090	62,941,681
Uruguay	Jan. 1	72,917,218	90,743.833	99,840,335	[b] 84,129,000	[d] 84,129,000
Other countries	....	156,086,187	105,659,951	85,230,391	77,213,000	[b] 92,302,000
Total	....	1,740,340,802	1,762,280,971	1,888,204,121	1,805,880,355	2,104,356,834

IMPORTS.

Country.	Year beginning—	1905.	1906.	1907.	1908.	1909.
Austria-Hungary	Jan. 1	59,692,125	81,968,287	52,919,967	60,634,821	67,222,884
Belgium	Jan. 1	140,786,550	134,875,551	148,253,340	131,118,370	131,380,685
British India	Jan. 1	16,757,543	22,387,912	20,626,006	18,470,491	20,252,059
Canada	Jan. 1	6,867,270	5,164,318	6,406,325	4,468,680	8,235,570
France	Jan. 1	480,776,007	538,280,408	554,982,155	504,910,496	622,749,015
Germany[g]	Jan. 1	446,726,304	438,284,806	439,917,329	430,576,566	471,480,165
Japan	Jan. 1	14,085,106	13,413,886	22,684,732	9,416,601	13,337,138
Netherlands	Jan. 1	37,692,892	34,783,842	24,081,928	31,714,118	28,612,749
Russia	Jan. 1	60,795,682	69,585,429	78,494,890	71,353,043	[b] 69,336,576
Sweden	Jan. 1	10,114,559	10,807,835	11,622,335	12,050,823	11,116,358
Switzerland	Jan. 1	10,981,002	11,464,696	10,323,804	11,097,626	11,524,546
United Kingdom	Jan. 1	369,465,005	406,403,772	527,766,993	470,804,920	500,198,977
United States	Jan. 1	246,821,389	196,844,298	188,305,955	142,559,384	312,131,171
Other countries	....	49,382,190	44,973,075	44,401,449	48,431,000	[b] 55,158,000
Total	....	1,950,943,624	2,009,238,115	2,130,787,208	1,947,606,939	2,322,735,893

[a] See "General note," p. 507.
[b] Preliminary.
[c] Cape Colony before 1906.
[d] Year preceding.
[e] Data for 1907.
[f] Data for 1905
[g] Not including free ports prior to March 1, 1906.

SWINE.

Number and farm value of swine on farms in the United States, 1867–1911.

January 1—	Number.	Price per head.	Farm value.	January 1—	Number.	Price per head	Farm value.
1867	24,694,000	$4.03	$99,637,000	1890	51,603,000	$4.72	$243,418,000
1868	24,317,000	3.29	79,976,000	1891	50,625,000	4.15	210,194,000
1869	23,316,000	4.65	108,431,000	1892	52,398,000	4.60	241,031,000
1870	26,751,000	5.80	155,108,000	1893	46,095,000	6.41	295,426,000
1871	29,458,000	5.61	165,312,000	1894	45,206,000	5.98	270,385,000
1872	31,796,000	4.01	127,453,000	1895	44,166,000	4.97	219,501,000
1873	32,632,000	3.67	119,632,000	1896	42,843,000	4.35	186,530,000
1874	30,861,000	3.98	122,695,000	1897	40,600,000	4.10	166,273,000
1875	28,062,000	4.80	134,581,000	1898	39,760,000	4.39	174,351,000
1876	25,727,000	6.00	154,251,000	1899	38,652,000	4.40	170,110,000
1877	28,077,000	5.66	158,873,000	1900	37,079,000	5.00	185,472,000
1878	32,262,000	4.85	156,577,000	1901	56,982,000	6.20	353,012,000
1879	34,766,000	3.18	110,508,000	1902	48,699,000	7.03	342,121,000
1880	34,034,000	4.28	145,782,000	1903	46,923,000	7.78	364,974,000
1881	36,248,000	4.70	170,535,000	1904	47,009,000	6.15	289,225,000
1882	44,122,000	5.97	263,543,000	1905	47,321,000	5.99	283,255,000
1883	43,270,000	6.75	291,951,000	1906	52,103,000	6.18	321,803,000
1884	44,201,000	5.57	246,301,000	1907	54,794,000	7.62	417,791,000
1885	45,143,000	5.02	226,402,000	1908	56,084,000	6.05	339,030,000
1886	46,092,000	4.26	196,570,000	1909	54,147,000	6.55	354,794,000
1887	44,613,000	4.48	200,043,000	1910	47,782,000	9.14	436,603,000
1888	44,347,000	4.98	220,811,000	1911	....	9.35	....
1889	50,302,000	5.79	291,307,000				

SWINE—Continued.

Wholesale prices of live hogs per 100 pounds, 1897–1910.

Date.	Cincinnati. Packing, fair to good.		St. Louis. Mixed packers.		Chicago.		Omaha.	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.
1897	$3.00	$4.45	$3.10	$4.50	$3.00	$4.65	$2.85	$4.17½
1898	3.15	4.45	3.10	4.55	3.10	4.80	3.10	4.60
1899	3.45	4.85	3.40	4.85	3.30	5.00	3.25	4.70
1900	4.45	5.85	4.40	5.75	3.35	5.85	4.15	5.62½
1901	5.15	7.20	4.90	7.10	3.00	7.40	4.45	6.85
1902	5.85	8.00	5.80	8.20	4.40	8.20	5.25	8.05
1903	4.15	7.75	4.20	7.60	3.75	7.85	4.10	7.55
1904	4.35	6.25	4.25	6.30	3.60	6.37½	4.20	6.05
1905	4.60	6.35	4.75	6.35	3.90	6.45	4.30	6.10
1906	5.30	6.95	5.10	6.97	4.60	7.00	4.85	6.75
1907.								
January	6.40	7.00	6.20	6.87	5.50	6.97½	6.15	6.90
February	6.80	7.40	6.65	7.22	6.00	7.25	6.67½	7.05
March	6.25	7.25	6.07	7.15	5.50	7.05	6.00	6.90
April	6.50	6.90	6.50	6.85	5.90	6.90	6.20	6.55
May	6.25	6.72	6.25	6.65	5.70	6.65	5.77½	6.50
June	5.75	6.30	5.87	6.47	5.40	6.42½	5.70	6.20
July	5.75	6.55	5.85	6.45	5.20	6.65	5.50	6.30
August	6.10	6.85	5.85	6.80	5.20	6.70	5.35	6.25
September	6.25	6.90	6.00	6.75	4.75	7.00	5.40	6.35
October	5.90	7.10	6.30	7.00	4.00	7.05	5.25	6.50
November	4.15	6.25	4.00	6.45	3.10	6.33½	3.80	5.75
December	4.25	5.35	4.25	5.30	3.50	5.25	4.10	4.80
Year	4.15	7.40	4.00	7.22	3.10	7.25	3.80	7.05
1908.								
January	4.15	4.70	4.20	4.62	3.95	4.72½	4.06	4.40
February	4.25	4.85	4.20	4.60	4.00	4.70	3.97	4.29
March	4.55	6.30	4.40	6.12	4.15	6.35	4.20	5.78
April	5.50	6.40	3.50	6.15	5.00	6.45	5.26	5.82
May	5.35	5.95	5.30	5.85	5.00	5.90	5.14	5.78
June	5.30	6.60	5.30	5.90	5.05	6.67½	5.23	6.03
July	6.35	7.10	5.90	6.90	5.60	7.10	5.95	6.44
August	6.10	7.15	6.25	6.90	5.60	7.10	6.17	6.53
September	6.00	7.35	6.40	7.35	6.05	7.60	6.43	6.90
October	4.85	7.00	5.10	7.15	4.70	7.20	5.21	6.63
November	5.10	6.20	5.40	6.05	4.65	6.40	5.54	5.89
December	5.25	6.25	5.30	5.90	4.60	6.15	5.30	5.79
Year	4.15	7.35	4.20	7.35	3.95	7.60	3.97	6.90
1909.								
January	5.75	6.75	5.75	6.60	5.20	[a] 6.70	5.25	6.35
February	6.15	7.10	6.05	6.75	5.75	6.95	5.50	6.60
March	6.30	7.30	6.10	7.05	5.95	7.15	5.65	6.95
April	6.80	7.55	6.75	7.45	6.50	7.60	6.40	7.30
May	7.05	7.55	6.95	7.40	6.75	7.55	6.60	7.45
June	7.05	8.15	7.10	8.00	6.80	8.20	6.90	7.90
July	7.40	8.40	7.60	8.20	7.00	8.45	7.20	8.05
August	7.75	8.30	7.60	8.10	6.95	8.25	7.20	7.95
September	7.60	8.45	7.70	8.40	7.20	8.60	7.45	8.30
October	7.25	8.15	7.25	8.05	6.85	8.40	7.00	8.00
November	7.55	8.25	7.70	8.40	7.20	8.45	7.55	8.15
December	7.95	8.80	7.80	8.65	7.65	8.75	7.30	8.50
Year	5.75	8.80	5.75	8.65	5.20	8.75	5.25	8.50
1910.								
January	8.00	9.00	7.70	8.85	7.75	9.05	7.91¾	8.56
February	8.25	9.85	8.00	9.65	8.05	10.00	8.28½	9.26⅛
March	9.75	11.10	9.50	10.95	9.45	11.20	9.46¾	10.71⅜
April	9.00	11.05	8.85	11.05	8.75	11.00	8.88½	10.60½
May	9.25	9.90	9.15	9.75	9.05	9.80	8.94½	9.44¾
June	9.10	9.70	9.22	9.67	9.10	9.80	8.99½	9.41½
July	8.45	9.40	8.40	9.60	8.30	9.60	7.71⅜	8.96⅜
August	8.35	9.60	8.00	9.35	8.20	9.70	7.59¾	9.00½
September	8.85	10.15	8.60	9.95	8.65	10.10	8.29½	9.27
October	8.65	9.35	8.25	9.37	8.25	9.65	8.01	8.55⅛
November	6.95	8.60	6.80	8.80	6.50	8.70	6.77¼	8.06½
December	7.25	8.20	7.00	8.05	6.80	8.10	7.26¼	7.79⅜
Year	6.95	11.10	6.80	11.05	6.50	11.20	7.26¼	10.71⅜

[a] Light to heavy.

CHICKENS.

Average price per pound received by farmers on the first of months indicated.

State, Territory, or Division.	1909. February.	April.	June.	August.	October.	December.	1910. January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	March, 1911.
	Cts.	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*
Maine	14	14	15	16	14	14	13.5	13.6	14.3	15.7	15.5	15.2	16.3	15.1	14.0	14.4	13.9	13.0	13.5
New Hampshire	16	14	13	13	14	13	12.6	12.9	13.5	14.2	15.5	16.0	15.0	15.6	13.6	15.0	13.6	13.8	14.1
Vermont	13	11	12	13	12	13	12.5	13.2	13.0	14.6	14.7	13.6	12.4	15.4	13.2	14.5	14.4	13.5	12.5
Massachusetts	16	14	15	16	17	16	15.5	16.0	16.0	16.7	17.2	17.7	18.0	19.0	18.0	18.1	17.6	16.0	15.9
Rhode Island	16	16	17	18	17	17	19.0	16.0	14.5	19.2	18.0	20.0	20.0	17.0	17.3	19.0	20.0	17.7	15.7
Connecticut	16	14	15	17	17	[illegible]	15.5	[illegible]	[illegible]	17.2	16.5	[illegible]	17.0	16.2	17.0	17.5	18.0	16.5	15.2
New York	12	13	14	14	14	13	13.6	13.5	[illegible]	14.8	14.9	[illegible]	[illegible]	16.5	15.6	15.1	14.7	13.5	13.5
New Jersey	14	15	16	17	16	[illegible]	15.5	15.7	14.8	17.5	18.1	[illegible]	[illegible]	18.8	18.0	17.7	18.0	17.0	15.4
Pennsylvania	11	12	12	13	13	12	12.0	12.4	13.0	13.9	14.3	14.3	13.9	14.3	13.6	13.7	13.5	12.4	12.4
N. Atlantic	12.5	13.0	13.5	14.2	14.1	13.2	13.4	13.5	14.2	15.0	15.2	15.7	15.3	15.0	15.0	15.1	14.8	13.7	13.5
Delaware	10	11	13	12	13	13	12.5	12.5	13.3	14.7	16.3	17.3	15.5	16.0	16.5	15.3	13.0	13.0	13.0
Maryland	11	13	14	15	14	13	13.0	12.9	14.9	14.7	16.8	17.2	14.8	15.8	14.5	14.7	14.4	13.2	14.0
Virginia	11	12	14	14	15	13	13.0	12.9	13.7	14.0	15.6	15.2	15.7	15.1	14.4	14.6	14.6	13.5	12.8
West Virginia	11	10	11	11	12	11	11.5	11.5	11.8	11.6	12.2	12.4	13.3	13.1	12.8	12.6	12.7	12.0	11.6
North Carolina	10	10	11	11	12	[illegible]	[illegible]	10.8	10.7	11.5	12.6	12.7	12.2	12.0	11.6	12.2	12.1	11.5	10.7
South Carolina	11	11	12	11	11	12	11.1	11.2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	11.5	11.4	12.5	11.0
Georgia	11	12	12	13	13	[illegible]	11.8	12.0	[illegible]	[illegible]	12.7	[illegible]	[illegible]	[illegible]	[illegible]	14.2	13.8	13.5	12.6
Florida	12	13	12	14	13	[illegible]	13.3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	12.7	[illegible]	12.6	14.0	13.7	15.0	12.1
S. Atlantic	10.8	11.4	12.3	12.6	13.0	12.5	11.8	11.9	12.1	13.6	13.6	13.8	13.8	13.4	13.1	13.5	13.3	12.9	12.1
Ohio	10	11	11	12	12	11	11.0	11.5	12.2	12.7	13.2	13.2	12.9	12.5	12.4	12.0	11.1	9.7	10.9
Indiana	10	11	11	11	11	11	11.2	11.4	12.2	12.5	13.0	12.6	12.6	12.5	11.7	11.3	10.4	9.3	10.1
Illinois	10	10	11	10	11	10	11.0	11.2	12.4	12.5	13.1	12.7	12.1	12.5	11.9	11.4	10.2	9.7	9.9
Michigan	9	10	10	11	11	10	11.0	11.3	11.8	12.2	11.9	11.9	11.8	12.2	11.8	11.7	10.8	10.0	10.2
Wisconsin	9	10	11	11	11	10	10.2	10.6	11.4	11.6	12.1	12.3	12.6	12.4	12.2	10.9	10.9	9.5	11.0
N.C.E.Miss.R.	9.7	10.4	10.9	11.0	11.2	10.4	10.9	11.2	12.1	12.4	12.8	12.6	12.4	12.4	12.0	11.5	10.6	9.6	10.4
Minnesota	8	9	10	10	9	9	9.3	9.3	9.5	10.1	9.9	10.1	10.1	10.4	10.5	9.6	9.2	8.8	9.0
Iowa	9	9	10	10	11	10	10.0	10.4	10.8	10.9	11.0	10.6	11.1	11.1	10.5	10.2	9.5	8.7	9.0
Missouri	9	10	10	11	10	10	10.1	10.5	11.5	12.0	12.7	12.3	12.6	11.1	10.8	10.2	10.2	9.0	9.4
North Dakota	8	8	9	10	9	9	9.0	9.6	9.5	10.4	10.5	10.1	10.6	10.5	10.3	10.4	9.9	9.0	9.2
South Dakota	9	8	8	9	9	9	9.0	9.4	9.0	9.1	9.8	9.3	9.6	9.5	9.3	9.4	8.8	8.6	8.7
Nebraska	8	8	9	10	9	9	9.1	9.1	9.7	9.6	10.4	10.2	10.2	10.5	10.1	9.7	9.1	8.5	8.4
Kansas	8	8	9	9	9	9	9.0	9.5	10.1	10.4	10.7	10.5	10.4	10.2	10.1	9.8	9.2	8.7	8.8
N.C.W.Miss.R.	8.6	8.9	9.6	10.0	9.8	9.4	9.6	9.9	10.4	10.7	11.1	10.8	11.0	10.7	10.4	10.0	9.5	8.8	9.0
Kentucky	9	10	11	12	11	10	10.3	10.8	11.6	11.6	12.4	12.0	12.8	11.4	11.4	11.1	10.6	9.9	9.9
Tennessee	9	10	12	11	10	10	10.1	10.5	10.9	11.2	12.5	12.7	12.5	[illegible]	[illegible]	11.3	11.1	10.3	10.0
Alabama	9	11	11	10	12	12	11.2	10.5	11.9	[illegible]	11.2	12.0	[illegible]	[illegible]	[illegible]	11.8	12.4	12.2	[illegible]
Mississippi	10	10	12	12	12	12	[illegible]	12.0	11.5	[illegible]	11.8	11.7	11.0	[illegible]	[illegible]	[illegible]	[illegible]	12.5	11.7
Louisiana	11	11	12	12	12	[illegible]	11.8	12.0	12.5	12.8	12.7	11.0	[illegible]	12.0	13.4	13.4	13.3	13.5	13.0
Texas	9	8	9	9	9	9	9.5	[illegible]	8.6	9.0	9.0	9.4	9.5	9.6	9.8	9.8	9.7	9.7	8.4
Oklahoma	8	8	9	9	9	9	8.7	8.7	9.2	9.9	10.1	10.2	10.4	9.7	9.4	9.4	9.6	9.5	8.8
Arkansas	9	8	9	10	10	10	9.1	9.0	9.4	9.4	9.9	10.4	11.0	10.5	10.5	10 2	10.2	9.7	10.2
S. Central	9.2	9.2	10.4	10.4	10.3	10.3	10.0	10.1	10.3	10.5	11.1	11.2	11.3	10.8	10.8	10.8	10.9	10.6	9.9
Montana	15	13	15	15	16	14	14.7	15.4	15.1	15.5	14.8	14.8	16.0	16.5	14.9	14.6	15.0	13.7	15.6
Wyoming	15	15	14	15	13	[illegible]	15.0	15.5	14.8	16.6	15.7	17.2	14.7	15.4	14.8	15.7	15.6	15.6	13.5
Colorado	12	12	11	12	13	13	13.0	13.0	[illegible]	[illegible]	13.4	[illegible]	[illegible]	15.7	[illegible]	13.0	11.0	12.5	13.3
New Mexico	9	12	11	14	13	[illegible]	12.5	13.0	12.5	[illegible]	12.3	11.9	12.2	13.2	[illegible]	12.4	12.8	12.8	14.5
Arizona	12	15	16	18	19	18	20.0	20.0	17.2	[illegible]	[illegible]	[illegible]	14.2	15.7	[illegible]	13.2	[illegible]	17.0	[illegible]
Utah	13	13	13	12	14	12	12.5	12.3	10.5	[illegible]	[illegible]	[illegible]	13.1	14.7	[illegible]	13.7	11.0	12.3	12.3
Nevada	13	18	25	24	19	18	19.0	19.0	25.0	22.0	15.0	[illegible]	[illegible]	[illegible]	[illegible]	15.0	11.7	18.0	14.4
Idaho	11	11	11	11	11	12	12.5	11.0	12.5	11.1	[illegible]	12.5	12.8	[illegible]	[illegible]	14.8	13.7	12.1	12.5
Washington	13	13	13	13	14	[illegible]	13.5	12.0	13.5	14.5	15.2	15.2	15.1	[illegible]	[illegible]	14.5	15.3	14.8	14.9
Oregon	11	11	11	12	11	12	12.0	13.0	[illegible]	12.7	[illegible]	13.0	12.5	[illegible]	[illegible]	[illegible]	12.8	13.8	13.4
California	14	13	14	15	15	15	[illegible]	15.0	14.4	[illegible]	[illegible]	[illegible]	13.8	[illegible]	14.5	14.4	15.1	15.6	14.8
Far Western	10.4	12.6	13.0	13.7	13.9	13.8	13.8	14.0	13.7	14.0	14.7	14.4	13.9	14.7	14.3	13.9	14.4	14.5	14.3
United States	9.9	10.2	10.9	11.2	11.3	10.8	10.9	11.1	11.6	11.9	12.4	12.4	12.3	12.2	11.9	11.6	11.3	10.6	10.6

EGGS.

Average price per dozen received by farmers on the first of months indicated.

State, Territory, or Division.	1909.						1910.												March, 1911.
	February.	April.	June.	August.	October.	December.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	
	Cts.	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*
Maine	31	20	21	26	30	39	37	32	26	23	21	22	24	25	27	31	35	40	22
New Hampshire	30	21	22	28	32	42	39	33	27	23	23	25	25	27	28	32	35	39	26
Vermont	30	20	21	25	28	39	37	32	27	22	21	21	23	24	28	29	34	37	22
Massachusetts	31	23	26	32	40	47	45	38	32	26	27	30	31	33	34	38	45	50	29
Rhode Island	34	20	25	31	37	45	49	42	29	25	22	28	30	32	35	40	40	50	28
Connecticut	30	21	26	28	34	46	40	38	32	25	23	26	27	30	34	37	43	45	26
New York	30	20	22	25	29	38	38	36	29	21	21	21	23	25	27	29	33	39	23
New Jersey	31	21	24	29	32	41	40	37	30	24	24	26	26	28	29	32	38	40	23
Pennsylvania	30	19	20	24	27	34	34	34	28	21	20	21	22	23	24	26	30	34	20
N. Atlantic	30.3	20.0	21.8	25.7	29.7	38.0	37.3	35.1	28.7	22.0	21.4	22.4	23.8	25.4	27.0	29.4	33.8	38.4	22.5
Delaware	27	18	22	23	27	35	34	31	25	20	21	21	20	22	24	27	32	33	20
Maryland	27	16	20	21	25	31	32	30	23	20	19	20	19	19	22	25	28	32	17
Virginia	23	17	18	18	23	27	28	28	23	18	18	18	18	18	19	23	25	28	16
West Virginia	25	17	17	19	22	27	28	28	25	18	18	19	19	20	21	22	25	29	17
North Carolina	19	15	16	16	21	24	25	25	21	16	17	17	17	16	18	21	22	24	15
South Carolina	20	17	16	16	21	27	27	25	22	19	19	19	18	17	20	23	25	27	18
Georgia	20	16	17	17	22	26	27	26	22	19	20	19	19	19	20	23	26	29	18
Florida	25	18	19	20	25	31	30	27	25	23	22	22	21	22	24	24	23	31	20
S. Atlantic	22.6	16.5	17.6	18.1	22.6	27.3	28.0	27.3	22.9	18.4	18.6	18.7	18.4	18.5	20.1	22.9	25.2	28.3	16.9
Ohio	27	17	20	21	23	30	31	31	24	19	19	19	19	19	20	23	26	31	16
Indiana	27	17	19	20	21	29	29	29	22	18	19	18	18	16	19	22	25	29	14
Illinois	27	16	19	19	21	27	30	29	22	18	19	18	17	16	18	21	24	28	15
Michigan	26	19	19	21	23	27	30	29	25	20	19	20	19	19	21	22	25	28	18
Wisconsin	28	17	19	19	21	27	31	30	24	19	18	18	18	17	18	21	25	27	17
N.C.E.Miss.R.	27.0	17.1	19.3	20.0	21.8	28.2	30.2	29.7	23.3	18.7	18.9	18.6	18.2	17.4	19.2	21.9	25.0	28.9	15.8
Minnesota	27	16	18	19	20	27	30	28	22	18	18	17	17	15	17	20	23	27	16
Iowa	25	16	18	18	20	25	28	28	21	18	18	17	16	14	17	20	22	25	14
Missouri	25	17	17	16	18	24	27	26	21	18	17	16	15	12	15	19	21	25	13
North Dakota	27	16	16	17	20	27	31	30	26	18	16	15	16	17	18	20	24	27	22
South Dakota	27	15	17	17	19	26	29	29	22	16	17	16	17	15	16	20	22	25	16
Nebraska	24	15	17	16	19	25	29	27	20	17	17	17	16	13	15	19	22	25	14
Kansas	25	15	17	16	18	25	30	25	20	17	17	16	15	12	15	19	21	25	13
N.C.W.Miss.R.	25.3	15.9	17.4	17.0	19.0	25.1	28.6	26.9	21.0	17.6	17.4	16.5	15.7	13.9	15.9	19.5	21.7	25.3	14.1
Kentucky	22	15	15	16	18	24	25	26	20	16	18	16	16	14	16	19	22	25	13
Tennessee	21	15	15	15	19	24	26	26	20	16	17	16	16	14	16	19	21	26	13
Alabama	18	14	15	14	19	23	25	23	19	16	16	16	16	15	17	20	21	25	15
Mississippi	20	15	16	16	19	24	26	25	21	17	16	17	17	16	19	20	22	23	16
Louisiana	22	16	17	18	20	24	25	25	19	19	18	18	17	17	19	19	24	25	17
Texas	19	13	14	14	18	23	28	25	18	15	16	14	14	14	16	19	21	25	14
Oklahoma	23	14	16	15	18	24	30	25	20	16	16	15	15	14	14	19	22	25	14
Arkansas	21	14	15	15	18	23	25	24	19	17	16	16	17	16	17	20	22	24	14
S. Central	20.5	14.2	15.0	15.1	18.4	23.5	26.5	25.0	19.3	16.1	16.6	15.6	15.6	14.7	16.4	19.3	21.6	24.9	14.1
Montana	37	26	26	30	36	43	46	46	39	28	25	26	27	30	32	33	36	40	34
Wyoming	33	25	22	26	28	36	40	42	32	28	24	25	24	28	25	33	31	36	23
Colorado	32	21	20	23	27	34	39	34	26	22	21	24	24	24	27	30	32	34	24
New Mexico	30	23	21	26	26	31	34	35	28	26	21	22	23	23	26	30	27	33	25
Arizona	38	28	30	28	34	39	45	44	35	30	30	30	30	33	34	33	36	41	30
Utah	28	19	20	20	28	33	38	36	22	19	20	20	21	23	24	24	29	33	22
Nevada	45	30	35	37	38	47	60	55	45	37	32	28	32	33	33	38	34	45	35
Idaho	34	23	22	26	28	35	41	42	35	25	23	23	25	26	30	31	35	39	30
Washington	40	23	24	28	32	42	46	38	31	25	24	24	25	28	31	34	38	42	27
Oregon	34	21	22	26	29	39	42	33	29	22	23	24	26	27	28	32	35	39	27
California	34	21	23	26	34	44	44	33	26	20	22	23	24	26	29	35	39	44	24
Far Western	34.3	21.8	22.7	25.8	31.6	40.5	42.8	35.5	28.1	22.2	22.5	23.5	24.5	26.3	28.8	32.8	36.2	40.6	25.5
United States	25.8	16.8	18.4	19.2	22.1	28.4	30.5	28.9	22.9	18.6	18.6	18.3	18.2	17.6	19.4	22.4	25.3	29.0	16.5

EGGS—Continued.

Receipts of eggs at seven leading markets in the United States, 1891–1910.

[From Board of Trade, Chamber of Commerce, and Merchants' Exchange reports.]

Year.	New York.	Chicago.	Boston.	St. Louis.	Cincinnati.	Milwaukee.	San Francisco.	Total.
	Cases.	*Cases.*	*Cases.*	*Cases.*	*Cases.*	*Cases.*	*Cases.*	*Cases.*
1891	1,867,681	1,508,417	641,203	501,313	a 262,694	90,558	169,022	5,040,888
1892	2,022,008	1,955,696	688,227	469,216	272,661	80,395	176,964	5,665,167
1893	2,113,180	1,718,061	718,653	562,359	318,881	83,432	157,190	5,671,756
1894	2,323,511	2,097,179	781,918	598,773	321,011	97,557	162,712	6,382,661
1895	2,243,349	2,115,974	781,812	654,938	267,494	102,773	164,407	6,330,747
1896	2,633,932	2,301,499	875,518	796,490	361,265	106,565	164,732	7,240,001
1897	2,719,987	1,962,134	912,712	894,906	339,457	115,686	181,407	7,126,289
1898	2,542,090	2,147,950	889,216	898,984	306,423	115,652	203,380	7,103,695
1899	2,624,424	2,096,100	900,219	751,224	389,543	110,696	237,355	7,109,561
1900	2,799,937	2,475,473	986,367	920,682	414,623	118,036	183,563	7,898,681
1901	2,909,194	2,783,709	1,040,555	1,022,646	493,218	128,179	277,500	8,655,001
1902	2,743,642	2,659,340	1,053,165	825,999	464,799	114,732	285,058	8,146,735
1903	2,940,091	3,279,248	1,164,777	959,648	338,327	129,278	335,228	9,146,597
1904	3,215,924	3,113,858	1,122,819	1,216,124	377,263	166,409	319,637	9,532,034
1905	3,477,638	3,117,221	1,395,385	980,257	420,604	159,990	307,243	9,858,338
1906	3,981,013	3,583,878	1,709,531	1,023,125	484,208	187,561	137,074	11,106,390
1907	4,262,153	4,780,356	1,594,576	1,288,977	588,636	176,826	379,439	13,070,963
1908	3,703,990	4,569,014	1,436,786	1,439,868	441,072	207,558	347,436	12,145,724
1909	3,903,867	4,557,906	1,417,397	1,395,987	519,652	160,418	340,185	12,295,412
1910	4,377,413	4,492,483	1,431,686	1,368,280	504,739	169,352	469,698	12,813,651
Averages:								
1891–1895	2,113,946	1,879,065	722,363	557,320	288,548	90,943	166,059	5,818,244
1896–1900	2,664,074	2,196,631	912,807	852,457	362,262	113,327	194,087	7,295,645
1901–1905	3,057,298	2,990,675	1,155,340	1,000,935	418,842	139,718	304,933	9,067,741
1906–1910	4,045,687	4,396,727	1,517,995	1,303,247	507,661	180,343	334,766	12,286,426
1910.								
January	137,408	65,172	25,074	25,084	12,874	2,022	24,319	291,953
February	231,622	137,575	66,307	95,832	24,298	5,257	40,913	601,804
March	476,841	347,611	156,336	210,117	87,503	22,469	59,809	1,360,686
April	723,257	773,656	305,220	298,739	104,403	34,434	54,357	2,294,066
May	615,813	788,995	285,208	213,682	62,532	28,553	55,057	2,049,840
June	569,009	731,383	190,667	167,992	46,561	18,254	46,707	1,770,573
July	410,728	479,504	128,308	101,431	32,314	13,919	38,747	1,204,951
August	334,202	371,806	99,550	63,745	27,434	13,885	41,809	952,431
September	300,768	336,522	63,567	59,984	20,863	12,145	25,803	819,652
October	248,442	215,216	48,561	54,128	28,592	6,891	25,314	627,144
November	153,861	140,011	38,670	36,787	26,756	7,810	24,579	428,474
December	175,462	105,032	24,218	40,759	30,609	3,713	32,284	412,077

a Year ending August 31. Subsequent years are calendar years.

TRANSPORTATION.

Tonnage carried on railways in the United States, 1905–1909.[a]

[From reports of the Interstate Commerce Commission. Tons of 2,000 pounds.]

Products.	Year ending June 30—				
	1905.	1906.	1907.	1908.	1909.
FARM PRODUCTS.					
Animal matter:	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Animals, live	10,611,555	11,089,456	11,727,889	11,541,195	11,699,070
Packing-house products—					
Dressed meats	1,617,395	1,813,485	1,952,538	2,081,155	2,131,803
Hides (including leather)	982,267	1,028,148	1,082,585	937,872	1,155,884
Other packing-house products	2,502,016	2,480,537	2,312,313	2,054,744	1,982,194
Total packing-house products	5,101,678	5,322,170	5,347,436	5,073,771	5,269,881
Poultry (including game and fish)	750,390	867,811	838,905	717,201	713,012
Wool	387,034	353,436	329,786	317,391	403,904
Other animal matter	1,305,086	1,369,952	2,229,470	1,985,592	2,507,485
Total animal matter	18,155,743	19,002,825	20,473,486	19,635,150	20,593,352
Vegetable matter:					
Cotton	3,962,183	3,428,880	4,332,664	3,419,173	3,950,479
Fruit and vegetables	9,230,535	8,921,262	9,719,117	9,516,962	9,762,769
Grain and grain products—					
Grain	30,906,440	35,856,333	36,715,384	33,058,061	34,111,231
Grain products—					
Flour	6,589,785	7,331,610	7,880,527	6,871,886	7,744,810
Other grain products	4,639,411	5,042,884	5,698,119	5,153,412	5,210,092
Total grain and grain products	42,135,636	48,230,827	50,294,030	45,083,359	47,066,133
Hay	5,191,830	5,479,755	5,847,828	5,446,336	5,453,515
Sugar	2,573,676	2,793,864	2,610,287	2,589,091	2,499,122
Tobacco	833,621	882,235	928,151	802,597	794,433
Other vegetable matter	3,283,230	3,258,761	5,908,281	5,397,516	6,656,391
Total vegetable matter	67,210,711	72,995,584	79,640,358	72,255,034	76,182,842
Total farm products	85,366,454	91,998,409	100,113,844	91,890,184	96,776,194
OTHER FREIGHT.					
Products of mines	383,562,335	435,450,476	476,899,638	444,216,023	459,560,732
Products of forests	80,436,863	92,187,351	101,617,724	90,475,081	97,104,700
Manufactures (except sugar)	94,759,092	118,664,874	135,011,156	102,271,178	106,178,007
All other (including freight in less than carload lots)	71,538,698	81,863,517	79,542,610	68,363,633	66,873,132
Grand total	715,663,442	820,164,627	893,184,972	797,216,099	826,492,765

[a] Original shipments only, excluding freight received by each railway from connecting railways and other carriers.

TRANSPORTATION—Continued.

Average receipts by railroads for freight traffic, per short ton per mile, 1890–1909.

Year ending June 30—	Group.[a]										Total United States.
	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
1890	1.373	0.828	0.695	0.844	1.061	0.961	1.360	1.152	1.303	1.651	0.941
1891	1.439	.760	.690	.852	1.018	.858	1.333	1.217	1.363	1.631	.895
1892	1.308	.755	.674	.811	.958	.983	1.293	1.159	1.328	1.646	.898
1893	1.298	.758	.663	.763	.927	.962	1.212	1.098	1.128	1.507	.878
1894	1.243	.754	.636	.730	.933	.942	1.141	1.054	1.209	1.343	.860
1895	1.223	.698	.642	.670	.895	.961	1.098	1.161	1.253	1.261	.839
1896	1.213	.672	.618	.660	.886	.917	1.121	1.055	1.118	1.254	.806
1897	1.202	.675	.605	.648	.864	.855	1.148	1.079	1.040	1.275	.798
1898	1.176	.617	.578	.592	.835	.826	1.157	.961	1.042	1.146	.753
1899	1.123	.582	.529	.594	.807	.821	1.101	.968	1.065	1.136	.724
1900	1.152	.613	.546	.595	.808	.806	1.064	.964	.938	1.067	.729
1901	1.151	.646	.568	.641	.802	.789	1.043	.971	1.018	1.055	.750
1902	[illegible]	.664	.576	.650	.816	.787	.994	.978	.984	1.037	.757
1903	[illegible]	.667	.607	.714	.827	.774	.980	.962	.974	1.005	.763
1904	1.196	.686	.620	.716	.851	.779	.964	.998	1.000	1.036	.780
1905	1.179	.665	.607	.691	.839	.766	.900	.988	1.096	1.098	.766
1906	1.172	.650	.594	.690	.813	.745	.894	.947	1.009	1.103	.748
1907	1.145	.655	.598	.703	.827	.743	.933	.966	1.051	1.163	.759
1908	1.110	.643	.594	.696	.825	.735	.942	.953	1.002	1.204	.754
1909	1.123	.647	.589	.669	.824	.748	.945	.981	1.070	1.223	.763
Mean:											
1891–1895	1.302	.745	.661	.765	.946	.941	1.215	1.138	1.256	1.478	.874
1896–1900	1.173	.632	.575	.618	.840	.845	1.118	1.005	1.041	1.176	.762
1901–1905	1.173	.666	.596	.682	.827	.779	.976	.979	1.014	1.046	.763
1906–1909	1.138	.649	.594	.690	.822	.743	.928	.962	1.033	1.173	.756

[a] Group I comprises the railroads of the New England States; Group II, New York (east of Buffalo), Pennsylvania (east of Pittsburg), New Jersey, Delaware, Maryland, and northern part of West Virginia; Group III, New York (west of Buffalo), Pennsylvania (west of Pittsburg), Ohio, Indiana, and the southern peninsula of Michigan; Group IV, Virginia, central and southern West Virginia, North Carolina, and South Carolina; Group V, Kentucky, Tennessee, Georgia, Florida, Alabama, Mississippi, and Louisiana (east of the Mississippi River); Group VI, northern peninsula of Michigan, Wisconsin, Illinois, Minnesota, Iowa, Missouri (north of the Missouri River), North Dakota (east of the Missouri River), and South Dakota (east of the Missouri River); Group VII, North Dakota (west of the Missouri River), South Dakota (west of the Missouri River), Nebraska, Montana, Wyoming, and northern Colorado; Group VIII, Missouri (south of Missouri River), Arkansas, Kansas, Oklahoma, central and southern Colorado, northeastern New Mexico, and the "panhandle" of Texas; Group IX, Texas (except the "panhandle") and southeastern New Mexico; Group X, Idaho, Utah, Nevada, western New Mexico, Arizona, Oregon, Washington, and California.

Corn and wheat: Mean proportional export freight rates per 100 pounds from Kansas City and Omaha, by rail, to leading Gulf and Atlantic ports, 1906–1910.

Destination and article.	From Kansas City.					From Omaha.				
	1906.	1907.	1908.	1909.	1910.	1906.	1907.	1908.	1909.	1910.
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
New Orleans:										
Corn	[a] 16.5	16.9	17.5	17.5	17.5	[a] 17.5	17.9	18.5	18.5	18.5
Wheat	[a] 17.1	17.9	18.5	18.5	18.0	[a] 18.1	18.9	19.5	19.5	19.5
Galveston:										
Corn	16.5	16.9	17.5	17.5	17.5	17.5	17.9	18.5	18.5	18.5
Wheat	17.1	17.9	18.5	18.5	18.5	18.1	18.9	19.5	19.5	19.5
Boston:										
Corn	23.4	23.4	24.0	24.0	24.0	23.4	23.4	24.0	24.0	24.0
Wheat	[b] 21.5	24.4	25.0	25.0	25.0	[b] 21.5	24.4	25.0	25.0	25.0
New York:										
Corn	23.4	23.4	24.0	24.0	24.0	23.4	23.4	24.0	24.0	24.0
Wheat	[b] 21.5	24.4	25.0	25.0	25.0	[b] 21.5	24.4	25.0	25.0	25.0
Philadelphia:										
Corn	22.4	22.4	23.0	23.0	23.0	22.4	22.4	23.0	23.0	23.0
Wheat	[b] 20.5	23.4	24.0	24.0	24.0	[b] 20.5	23.4	24.0	24.0	24.0
Baltimore:										
Corn	21.9	21.9	22.5	22.5	22.5	21.9	21.9	22.5	22.5	22.5
Wheat	[b] 20.0	22.9	23.5	23.5	23.5	[b] 20.0	22.9	23.5	23.5	23.5

[a] From Apr. 25 to Aug. 10, 1906, inclusive, rates used in computing this average include delivery on board ship.
[b] Average based upon rates in force for two periods, amounting together to about 30 days

TRANSPORTATION—Continued.

Wheat: Mean annual freight rates per bushel by lake from Chicago to ports west and east of Niagara River, 1871–1910.[a]

[All rates are gold.]

Year.	West of Niagara River.		East of Niagara River.	
	Buffalo.[b]	Depot Harbor.	Ogdensburg.	Montreal.
	Cents.	*Cents.*	*Cents.*	*Cents.*
Mean:				
1871–1875	6.4	....	....	....
1876–1880	4.0	....	....	....
1881–1885	2.8	....	....	[c] 6.8
1886–1890	3.1	....	....	[d] 7.5
1891–1895	2.0	....	[e] 3.4	[f] 5.6
1896–1900	1.9	....	[g] 3.4	[h] 5.2
1901–1905	1.6	1.6	[i] 3.7	[j] 4.9
1906–1910	1.4	1.5	4.0	5.0
1906	1.7	1.7	4.0	6.7
1907	1.6	1.6	4.2	5.6
1908	1.1	1.2	4.1	5.5
1909	1.4	1.4	3.7	4.0
1910	1.1	....	4.0	3.1

[a] Compiled from weekly quotations in annual reports of the Chicago Board of Trade.

[b] Mean rates to Buffalo from Chicago by sail vessels were: 1871–1875, 6.4 cents; 1876–1880, 4.1; 1881–1885, 3; and by steam vessels: 1871–1875, 6.3 cents; 1876–1880, 4; 1881–1885, 2.7 cents per bushel. For later years, mean rates by sail, when given, were practically the same as by steam vessels.

[c] Average, 1883-1885.

[d] Average, 1886-1889.

[e] Average, 1890, 1892, 1893.

[f] Average, 1891, 1892, 1894, 1895.

[g] Average, 1898-1900.

[h] Average, 1896-1898.

[i] Average, 1900, 1903, 1905.

[j] 1903 only.

Wheat: Lowest and highest freight rates per bushel by lake to Buffalo from Toledo, Duluth, and Chicago, 1882–1910.[a]

Year.	To Buffalo from—					
	Toledo.		Duluth.		Chicago.	
	Low.	High.	Low.	High.	Low.	High.
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
1882	....	....	....	....	1.50	3.50
1883	....	....	....	....	2.20	5.25
1884	....	....	....	....	1.60	3.00
1885	....	....	1.50	5.00	1.10	3.75
1886	1.75	3.00	3.25	8.00	2.00	5.875
1887	2.25	3.00	5.00	8.00	3.00	6.00
1888	1.50	2.125	2.00	5.00	1.70	4.00
1889	1.75	2.00	2.00	5.00	2.00	3.60
1890	1.50	2.00	2.00	5.00	1.50	2.50
1891	1.00	3.00	1.25	9.50	1.00	5.25
1892	1.50	2.50	2.25	4.00	1.00	3.00
1893	1.00	2.00	1.25	3.50	1.00	2.75
1894	1.00	2.00	1.25	3.00	.875	3.00
1895	1.00	2.25	2.00	6.00	1.00	3.00
1896	1.25	1.75	1.25	3.00	1.25	2.625
1897	1.00	1.25	1.00	2.50	1.00	2.625
1898	1.00	1.50	1.00	3.50	1.25	3.25
1899	1.50	2.00	2.50	6.00	1.875	3.75
1900	1.25	2.00	1.50	3.75	1.25	3.00
1901	1.25	1.50	1.125	3.75	1.25	2.50
1902	1.125	2.00	1.00	2.25	1.375	2.125
1903	1.125	1.50	1.125	2.75	1.25	2.25
1904	1.00	1.75	1.00	5.00	1.00	3.00
1905	1.125	2.50	1.25	4.00	1.125	3.00
1906	1.375	1.50	1.75	3.00	1.375	2.125
1907	1.00	1.50	1.00	2.50	1.125	2.00
1908	1.00	1.50	1.00	3.50	.75	1.50
1909	1.00	1.50	1.00	2.75	1.10	2.00
1910	1.25	1.25	1.00	2.00	1.00	1.75

[a] Compiled from annual reports of the Buffalo Merchants' Exchange and Buffalo Chamber of Commerce, except figures for Toledo, 1905–1910, which were supplied by the secretary of the Toledo Produce Exchange.

TRANSPORTATION—Continued.

Corn and wheat: Mean freight rates per bushel from Chicago to New York, 1876–1910.

[Data furnished by the Chicago Board of Trade. Rates for 1876–1878, inclusive, are reduced to gold.]

Year.	Corn.			Wheat.		
	By lake and canal.[a]	By lake and rail.	By all rail.	By lake and canal.[a]	By lake and rail.	By all rail.
	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.
1876	7.85	9.68	14.12	8.81	10.19	15.12
1877	9.15	13.42	18.03	10.58	14.75	19.56
1878	8.76	10.45	16.39	9.88	11.99	17.56
1879	10.49	12.20	14.56	11.87	13.13	17.74
1880	13.41	14.43	17.48	13.13	15.80	19.80
1881	7.77	9.42	13.40	8.67	10.49	14.40
1882	6.72	10.28	13.50	7.23	10.91	14.47
1883	8.03	11.00	15.12	9.01	11.63	16.20
1884	6.55	8.50	12.32	7.00	10.00	13.20
1885	6.30	8.01	12.32	6.54	9.02	13.20
1886	8.45	11.20	14.00	9.10	12.00	15.00
1887	8.50	11.20	14.70	9.50	12.00	15.75
1888	6.71	10.26	13.54	7.05	11.14	14.50
1889	6.32	8.19	12.60	6.92	8.97	15.00
1890	5.93	7.32	11.36	6.76	8.52	14.30
1891	6.32	7.53	14.00	6.95	8.57	15.00
1892	5.95	7.21	12.96	6.45	7.59	13.80
1893	7.18	7.97	13.65	7.66	8.48	14.63
1894	4.93	6.50	12.32	5.11	7.00	13.20
1895	4.50	6.40	10.29	4.86	6.96	11.89
1896	5.75	6.15	10.50	6.19	6.61	12.00
1897	4.53	6.92	11.43	5.22	7.42	12.50
1898	[b] 3.81	4.41	9.80	[b] 4.45	4.91	12.00
1899	[b] 5.08	5.83	10.08	[b] 5.81	6.63	11.60
1900	[b] 4.07	4.72	9.19	[b] 4.49	5.10	9.96
1901	[b] 4.61	5.16	9.21	[b] 5.11	5.54	9.88
1902	[b] 4.83	5.51	9.94	[b] 5.26	5.89	10.62
1903	[b] 4.85	5.78	10.54	[b] 5.40	6.37	11.29
1904	[b] 3.63	4.82	10.38	[b] 4.73	5.50	11.12
1905	[b] 4.76	5.19	9.40	[b] 5.53	6.40	9.90
1906	[b] 5.51	5.72	9.52	[b] 6.03	6.35	10.20
1907	[b] 6.12	6.20	10.17	[b] 6.65	7.09	10.90
1908	[b] 5.62	5.79	9.89	[b] 6.05	6.60	10.60
1909	[b] 4.87	5.89	9.30	[b] 5.24	6.49	9.96
1910	[b] 4.59	5.77	8.20	[b] 4.92	6.57	8.80
Mean:						
1876–1880	9.93	12.04	16.12	10.85	13.17	17.96
1881–1885	7.07	9.44	13.33	7.69	10.41	14.29
1886–1890	7.18	9.63	13.24	7.87	10.53	14.91
1891–1895	5.78	7.12	12.64	6.21	7.72	13.70
1896–1900	[c] 4.65	5.61	10.20	[c] 5.23	6.13	11.61
1901–1905	[b] 4.54	5.29	9.89	[b] 5.21	5.94	10.56
1906–1910	[b] 5.34	5.87	9.42	[b] 5.78	6.62	10.09

[a] Including Buffalo charges and tolls.
[b] Excluding Buffalo charges.
[c] Including, in 1896 and 1897, Buffalo charges and tolls.

Meats, packed, Cincinnati to New York, by rail: Mean rates, per 100 pounds, 1881–1910.

Year.	Rate.	Year.	Rate.	Year.	Rate.
	Cents.		Cents.		Cents.
1881	26.7	1894	26.0	1906	26.0
1882	25.8	1895	26.0	1907	26.0
1883	27.8	1896	26.0	1908	26.0
1884	24.2	1897	26.0	1909	26.0
1885	21.1	1898	26.0	1910	26.0
1886	26.1	1899	24.9	Mean:	
1887	27.1	1900	26.0	1881–1885	25.1
1888	23.1	1901	26.0	1886–1890	25.3
1889	26.0	1902	26.0	1891–1895	25.3
1890	23.9	1903	26.0	1896–1900	25.8
1891	25.4	1904	26.0	1901–1905	25.8
1892	23.7	1905	25.0	1906–1910	26.0
1893	25.4				

TRANSPORTATION—Continued.

Live stock and dressed meats: Mean freight rates per 100 pounds from Chicago to New York, by rail, 1881–1910.

Year.	Cattle.	Hogs.	Sheep.	Horses and mules.	Dressed beef.	Dressed hogs. Refrigerator cars.	Dressed hogs. Common cars.
	Cts.	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*
1881	35	31	61	60	56	......	......
1882	36	29	53	60	57	......	......
1883	40	32	50	60	64	......	......
1884	31	28	44	60	51	......	......
1885	31	26	43	60	54	......	......
1886	33	30	42	60	61	53	48
1887	33	32	40	60	62	59	54
1888	22	26	31	60	46	46	44
1889	25	30	30	60	47	47	45
1890	23	28	30	60	39	39	39
1891	27	30	30	60	45	45	45
1892	28	28	30	60	45	45	45
1893	28	20	30	60	45	45	45
1894	28	30	30	60	45	45	45
1895	28	30	30	60	45	45	45
1896	28	30	30	60	45	45	45
1897	28	30	30	60	45	45	45
1898	28	30	30	60	45	45	45
1899 [a]	25	25	25	60	40.0	40.0	40.0
1900	28	30	30	60	45.0	45.0	45.0
1901	28	30	30	60	42.9	42.9	42.9
1902	28	30	30	60	41.2	41.2	41.2
1903	28	30	30	60	45.0	45.0	45.0
1904	28	30	30	60	45.0	45.0	45.0
1905	28	30	30	60	45.0	45.0	45.0
1906	28	30	30	60	45.0	45.0	45.0
1907	28	30	30	60	45.0	45.0	45.0
1908	28	30	30	60	45.0	45.0	45.0
1909	28	30	30	60	45.0	45.0	45.0
1910	28	30	30	60	45.0	45.0	45.0
Mean:							
1881–1885	34.6	29.2	50.2	60	56.4	......	......
1886–1890	27.2	29.2	34.6	60	51.0	48.8	46.0
1891–1895	27.8	27.6	30.0	60	45.0	45.0	45.0
1896–1900	27.4	29.0	29.0	60	44.0	44.0	44.0
1901–1905	28.0	30.0	30.0	60	43.8	43.8	43.8
1906–1910	28.0	30.0	30.0	60	45.0	45.0	45.0

[a] Rates did not go into effect until February 1, 1899. Up to that time the 1898 rates governed.

Cotton: Mean annual quotations of freight rates per 100 pounds, by coastwise vessels, to New York from New Orleans and Savannah, 1886–1910.[a]

Year.	To New York from— New Orleans.	To New York from— Savannah.[b]
	Cents.	*Cents.*
1886	28.0	28.2
1887	32.0	28.4
1888	38.0	25.0
1889	42.0	27.6
1890	40.0	25.3
1891	40.0	26.5
1892	36.0	20.1
1893	30.0	20.2
1894	29.0	19.8
1895	30.0	20.0
1896	32.0	20.0
1897	26.0	19.8
1898	30.0	19.6
1899	28.0	20.1
1900	30.0	20.0
1901	30.0	23.3
1902	30.0	20.0
1903	30.0	20.0
1904	30.0	20.0
1905	29.0	20.0
1906	25.0	20.0
1907	25.0	20.0
1908	25.0	20.0
1909	25.0	20.0
1910	25.0	20.0
Mean:		
1886–1890	36.0	26.9
1891–1895	33.0	21.3
1896–1900	29.2	19.9
1901–1905	29.8	20.7
1906–1910	25.0	20.0

[a] Compiled from quotations published in daily newspapers or furnished by steamship agents.
[b] In 1901–1910 the rates from Savannah to New York, which included lighterage (transfer in New York Harbor), were about 3 cents per 100 pounds above the rates shown in this table.

TRANSPORTATION—Continued.

Compressed cotton: Mean freight rates per 100 pounds from New Orleans and Memphis, by rail, to North Atlantic ports, 1881–1910.

Year.	From New Orleans to— Boston.	From New Orleans to— New York.	From New Orleans to— Philadelphia.	From New Orleans to— Baltimore.	From Memphis to— New York.	From Memphis to— Boston.
	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.
1881	58	53	54	54	66. 0	71. 0
1882	53	48	51	51	61. 0	66. 0
1883	60	55	53	52	72. 0	77. 0
1884	60	55	53	52	54. 0	59. 0
1885	60	55	53	52	56. 6	58. 0
1886	52	47	45	44	53. 0	58. 0
1887	50	45	43	42	53. 0	58. 0
1888	50	45	43	42	47. 0	52. 0
1889	52	47	45	44	50. 5	55. 0
1890	55	50	50	50	50. 5	55. 0
1891	55	50	50	50	50. 5	55. 0
1892	55	50	50	50	50. 5	55. 0
1893	55	50	50	50	47. 0	52. 0
1894	51	50	50	50	50. 5	55. 5
1895	53	48	48	48	50. 5	55. 5
1896	55	50	50	50	50. 5	55. 5
1897	55	50	50	50	50. 0	55. 0
1898	55	50	50	50	47. 0	52. 0
1899	52	47	47	47	48. 0	53. 0
1900	55	50	50	50	50. 5	55. 5
1901	55	50	50	50	50. 5	55. 5
1902	55	50	50	50	50. 5	55. 5
1903	55	50	50	50	50. 5	55. 5
1904	55	50	50	50	50. 5	50. 5
1905	55	50	50	50	40. 5	45. 5
1906	55	50	50	50	40. 5	45. 5
1907	55	50	50	50	40. 5	45. 5
1908	55	50	50	50	42. 5	47. 5
1909	55	50	50	50	42. 5	47. 5
1910	55	50	50	50	42. 5	47. 5
Mean:						
1881–1885	58. 2	53. 2	52. 8	52. 2	61. 8	66. 2
1886–1890	51. 8	46. 8	45. 2	44. 4	50. 8	55. 6
1891–1895	53. 8	49. 6	49. 6	49. 6	49. 8	54. 6
1896–1900	54. 4	49. 4	49. 4	49. 4	49. 2	54. 2
1901–1905	55. 0	50. 0	50. 0	50. 0	48. 5	52. 5
1906–1910	55. 0	50. 0	50. 0	50. 0	41. 7	46. 7

Grain (except oats), cotton, and lard: Mean monthly quotations of ocean freight rates from United States ports to Liverpool, 1910.

Article and port.	Mean for month— Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Mean for year.
Grain, except oats (per 60 pounds):	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.
Boston	3. 28	2. 49	2. 10	2. 42	2. 62	2. 10	2. 10	2. 10	2. 31	4. 20	4. 20	3. 68	2. 80
New York [a]	3. 15	2. 62	2. 89	3. 15	3. 02	2. 62	2. 62	3. 02	3. 15	3. 99	3. 97	4. 33	3. 21
Baltimore [a]	3. 68	3. 15	3. 15	2. 62	1. 05	1. 58	2. 62	2. 62	2. 62	3. 15	......	5. 25	2. 86
New Orleans	5. 25	5. 25	5. 25	4. 86	4. 72	4. 72	4. 72	4. 94	5. 78	6. 82	7. 88	7. 63	5. 65
Galveston [b]	5. 25	5. 25	5. 25	5. 25	5. 25	5. 25	5. 25	5. 25	6. 00	6. 75	6. 00	6. 00	5. 56
Cotton (per 100 pounds):													
Boston	11. 50	10. 50	10. 00	10. 00	10. 00	10. 00	10. 00	10. 00	11. 20	15. 00	12. 75	12. 00	11. 08
New York	12. 75	14. 25	15. 88	14. 00	18. 25	18. 00	17. 00	18. 75	19. 25	22. 00	19. 00	15. 75	17. 07
Baltimore	16. 00	16. 00	16. 00	16. 00	16. 00	16. 00	16. 00	16. 00	17. 33	21. 00	22. 00	21. 60	17. 49
New Orleans	30. 00	28. 00	28. 50	28. 00	28. 00	28. 00	28. 00	29. 60	33. 50	38. 75	37. 20	35. 50	31. 09
Galveston	26. 00	28. 00	28. 00	28. 00	28. 00	28. 00	29. 00	31. 00	33. 50	37. 50	33. 50	33. 00	30. 29
Lard, small packages (per 100 pounds):													
Boston	22. 50	22. 50	22. 50	22. 50	22. 50	22. 50	22. 50	22. 50	22. 50	22. 50	22. 50	22. 50	22. 50
New York	22. 50	22. 50	22. 50	22. 50	22. 50	22. 50	22. 50	22. 50	22. 50	22. 50	22. 50	22. 50	22. 50
Baltimore	22. 50	22. 50	22. 50	22. 50	22. 50	22. 50	22. 50	22. 50	22. 50	22. 50	22. 50	23. 18	22. 56
New Orleans	30. 00	31. 25	35. 00	35. 00	25. 00	25. 00	25. 00	25. 00	25. 00	27. 50	30. 00	30. 00	28. 65
Galveston	19. 00	19. 00	20. 00	20. 00	21. 00	22. 00	22. 00	23. 00	23. 00	25. 00	25. 00	25. 00	22. 00

[a] Preliminary.

[b] Rates chiefly nominal.

TRANSPORTATION—Continued.

Grain (except oats) and cotton: Mean annual quotations of ocean freight rates per 100 pounds from various United States ports to Europe, 1886–1909.

[The rates in this table for grain (except oats) from New York were computed from data in the annual reports of the New York Produce Exchange, except for the last year from Baltimore, from reports of the Baltimore Chamber of Commerce. All other figures were computed from rates quoted in newspapers and in circulars issued by freight brokers and transportation companies.]

Calendar year.	Grain (except oats).				Cotton.					
	To Liverpool from—			To Cork for orders, from San Francisco.	To Liverpool from—			To Bremen from—		
	New York.	Baltimore.[a]	New Orleans.		New York.	Savannah.	New Orleans.	New York.	Savannah.	New Orleans.
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
1886	11.6	12.7	16.1	33.0	31.0	54.7	61.6	36.3	60.5	64.7
1887	8.8	10.3	15.0	29.0	27.7	62.4	59.2	38.3	63.8	68.2
1888	9.2	10.7	14.4	27.7	28.4	74.4	60.1	37.2	84.0	71.5
1889	13.8	15.5	19.0	33.1	41.9	80.6	71.0	68.6	83.6	78.8
1890	8.5	9.8	12.9	37.9	28.0	63.8	51.6	46.7	68.9	59.8
1891	10.9	11.9	14.8	43.2	31.3	64.2	46.7	37.6	71.5	49.5
1892	9.2	11.6	12.5	33.7	23.4	38.1	38.9	....	52.2	49.1
1893	8.3	10.0	13.6	22.6	26.8	43.9	40.5	35.5	44.3	45.2
1894	6.8	8.4	9.7	28.3	25.7	42.3	39.9	32.0	42.7	47.8
1895	9.0	7.5	10.3	28.1	21.2	36.2	34.9	27.4	36.9	41.9
1896	10.3	10.2	14.2	28.7	24.4	51.0	38.3	29.6	43.1	45.9
1897	10.7	11.1	13.4	26.8	20.4	42.3	34.0	30.3	44.0	42.7
1898	12.0	12.5	16.2	22.1	26.2	46.5	46.2	34.1	43.2	51.9
1899	8.5	10.1	13.1	27.9	18.7	37.8	38.7	28.1	37.1	44.8
1900	11.8	13.5	17.3	40.2	28.0	46.2	51.0	36.2	46.6	54.2
1901	4.4	6.3	8.7	41.5	13.4	31.4	32.5	23.2	30.1	37.6
1902	5.0	6.2	7.2	32.1	12.5	26.6	28.7	18.3	24.1	30.5
1903	5.0	5.4	8.3	18.5	14.8	26.8	34.6	23.3	26.1	33.8
1904	3.9	4.8	8.8	15.8	13.7	28.4	31.4	21.9	25.4	31.9
1905	5.7	6.4	10.6	23.2	16.6	27.8	33.8	21.2	26.6	32.7
1906	5.0	6.1	11.4	25.0	17.0	30.4	34.2	21.3	31.0	36.2
1907	6.1	6.3	11.8	24.8	18.6	31.3	35.9	20.5	32.4	36.6
1908	5.5	6.5	10.1	25.6	13.7	31.9	29.9	21.0	32.0	30.6
1909	5.7	5.1	8.8	25.5	13.4	25.4	28.0	17.7	25.1	28.0
1910	[b] 5.4	[b] 4.8	9.3	25.5	17.1	22.8	31.1	19.3	23.1	31.2
Mean:										
1886–1890	10.4	11.8	15.5	32.1	31.4	67.2	60.7	45.4	72.2	68.6
1891–1895	8.8	9.9	12.2	31.2	25.7	44.9	40.2	[c] 33.1	49.5	46.7
1896–1900	10.7	11.5	14.8	29.1	23.5	44.8	41.6	31.7	42.8	47.9
1901–1905	4.8	5.8	8.7	26.2	14.2	28.2	32.2	21.6	26.5	33.3
1906–1910	5.5	5.8	10.3	25.3	16.0	28.4	31.8	20.0	28.7	32.6

[a] Mean of daily quotations. [b] Preliminary. [c] Mean, 1891, 1893–1895.

Grain (except oats), flour, and provisions: Mean freight rates per 100 pounds through from Chicago to European ports, by all-rail to seaboard and thence by steamers, 1901–1910.

[Data furnished by the Chicago Board of Trade.]

Destination.	Article.	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910
		Cts.	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*
Liverpool	Grain	29.48	21.47	20.85	22.68	20.19	19.16	18.75	19.22	19.01	18.93	18.15
Do	Sacked flour	27.90	23.00	23.50	25.19	21.00	22.40	20.50	21.25	20.75	20.72	19.75
Do	Provisions	48.84	36.00	36.25	41.90	36.56	38.49	41.00	40.85	42.57	45.38	45.38
Glasgow	Grain	30.98	24.10	21.75	24.43	22.38	20.00	19.25	19.67	18.63	18.00	15.91
Do	Sacked flour	31.56	24.38	22.75	25.38	23.20	22.50	23.60	23.91	22.08	21.00	21.50
Do	Provisions	55.31	45.16	41.88	46.88	44.06	43.23	45.63	46.88	46.88	46.88	46.88
London	Grain	31.10	23.23	21.75	23.56	21.50	20.23	19.25	20.54	19.46	18.17	17.75
Do	Sacked flour	35.01	25.50	24.00	25.19	22.25	23.64	22.50	23.63	23.16	21.50	22.00
Do	Provisions	55.87	44.75	39.06	44.06	44.06	40.88	46.26	46.26	46.26	47.46	47.62
Antwerp	do	51.09	46.25	41.50	49.69	48.28	43.70	47.61	45.56	49.59	49.42	49.44
Hamburg	do	50.00	44.00	39.00	47.00	46.00	45.75	49.00	46.00	49.59	49.09	50.00
Amsterdam	do	51.00	45.00	40.00	42.00	42.00	45.42	46.00	45.00	45.00	48.00	48.00
Rotterdam	do	51.00	45.00	40.00	42.00	42.00	44.53	46.00	45.00	45.00	47.00	47.00
Copenhagen	do	55.31	47.75	42.00	49.69	46.88	48.66	51.00	51.00	53.96	55.31	55.31
Stockholm	do	64.50	53.25	45.00	52.50	49.69	51.47	53.50	53.00	54.66	56.72	56.72
Stettin	do	55.31	47.75	42.00	49.69	46.88	48.18	50.00	49.00	51.85	53.91	53.91
Bordeaux	do	64.12	54.25	51.25	56.25	56.25	51.45	53.00	55.00	55.00	55.00	57.50

IMPORTS AND EXPORTS OF AGRICULTURAL PRODUCTS.[a]

Agricultural imports of the United States during the five years ending June 30, 1910.

Article imported.	1906.		1907.		1908.		1909.		1910.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
ANIMAL MATTER.										
Animals, live:										
Cattle—										
For breeding purposes..number..	829	$118,368	835	$122,230	3,188	$149,142	3,049	$140,713	2,611	$291,139
Other....do....	28,190	430,062	31,567	442,892	89,168	1,358,168	136,135	1,858,709	193,327	2,708,685
Total cattle....do....	29,019	548,430	32,402	565,122	92,356	1,507,310	139,184	1,999,422	195,938	2,999,824
Horses—										
For breeding purposes....do....	3,377	1,266,987	3,644	1,574,020	3,562	1,325,784	4,953	1,658,640	7,867	2,660,241
Other....do....	2,644	449,688	2,436	404,085	1,925	278,608	2,131	348,636	3,753	635,781
Total horses....do....	6,021	1,716,675	6,080	1,978,105	5,487	1,604,392	7,084	2,007,276	11,620	3,296,022
Sheep—										
For breeding purposes....do....	2,679	53,951	3,081	67,555	5,609	104,509	4,860	89,272	6,335	135,019
Other....do....	238,068	966,408	221,717	1,052,870	219,156	978,097	97,803	413,368	119,817	561,860
Total sheep....do....	240,747	1,020,359	224,798	1,120,425	224,765	1,082,606	102,663	502,640	126,152	696,879
All other, including fowls....	....	628,958	....	680,630	....	583,151	....	528,333	....	846,945
Total live animals....	....	3,914,422	....	4,344,282	....	4,777,459	....	5,037,671	....	7,839,670
Beeswax....pounds..	587,617	168,014	917,088	264,637	671,526	194,769	764,937	231,559	972,145	282,905
Cochineal....do....	111,007	53,446	(b)	(b)	(b)	(b)	(b)	(b)	(b)	(b)
Dairy products:										
Butter....do....	196,642	57,955	441,755	117,835	780,608	182,897	646,320	141,917	1,360,245	298,023
Cheese....do....	27,286,866	4,303,830	33,848,766	5,704,012	32,530,830	5,586,706	35,548,143	5,866,154	40,817,524	7,053,570
Cream....gallons..	(b)	(b)	(b)	(b)	(b)	(b)	(b)	(b)	731,783	577,715
Milk....	....	10,858	....	10,188	....	11,496	....	23,428	....	63,339
Total dairy products....	....	4,372,643	....	5,832,035	....	5,781,099	....	6,031,499	....	7,092,647
Eggs....dozens..	241,034	21,200	231,859	26,276	231,939	25,850	288,650	36,937	818,267	110,738
Egg yolks....pounds..	(b)	10,992	(b)	10,616	(b)	10,845	(b)	6,232	869,923	56,121
Feathers and downs, crude....	....	2,970,260	....	4,401,131	....	4,360,721	....	5,507,974	....	7,113,778

[a] Forest products come within the scope of the Department of Agriculture and are therefore included in alphabetical order in these tables.

[b] Not stated.

Agricultural imports of the United States during the five years ending June 30, 1910—Continued.

Article imported.	1906.		1907.		1908.		1909.		1910.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
ANIMAL MATTER—continued.										
Fibers, animal:										
Silk—										
Cocoons ... pounds..	33,592	$11,452	71,223	$23,807	187	$292	14,016	$3,931	48,661	$14,426
Raw, or as reeled from the cocoon ... pounds..	14,505,324	52,855,611	16,722,207	70,229,518	15,424,041	63,665,534	23,333,750	78,830,568	20,363,327	65,424,784
Waste ... do....	2,813,105	1,213,441	1,950,474	1,158,574	1,237,904	881,077	1,840,191	1,069,087	3,045,235	1,690,393
Total silk ... do....	17,352,021	54,080,504	18,743,904	71,411,899	16,662,132	64,546,903	25,187,957	79,903,586	23,457,223	67,129,603
Wool, and hair of the camel, goat, alpaca, and like animals—										
Class 1, clothing ... pounds..	86,810,307	20,936,934	82,982,116	21,378,304	45,798,303	10,278,199	142,580,993	29,455,598	111,592,978	27,231,052
Class 2, combing ... do....	15,204,254	4,214,024	10,671,378	3,235,281	13,332,540	3,624,617	21,952,259	4,591,559	31,614,235	7,931,145
Class 3, carpet ... do....	99,674,107	13,917,414	110,194,051	16,920,443	66,849,681	9,762,122	101,876,052	11,124,837	120,721,019	16,058,647
Total wool ... do....	201,688,668	39,068,372	203,847,545	41,534,028	125,980,524	23,664,938	266,409,304	45,171,994	263,928,232	51,220,844
Total animal fibers ... do....	219,040,689	93,148,876	222,591,449	112,945,927	142,642,656	88,211,841	291,597,261	125,075,580	287,385,455	118,350,447
Gelatin ... do....	(a)	(a)	(a)	(a)	(a)	(a)	1,247,910	387,232	1,249,856	386,696
Glue ... do....	6,558,168	632,700	6,466,312	596,667	6,731,943	629,032	6,610,894	655,127	8,821,554	861,888
Honey ... gallons..	138,221	50,651	175,672	70,854	211,992	98,425	145,691	60,884	103,640	52,968
Packing-house products:										
Bladders, other than fish ...	...	23,915	...	11,835	...	4,905	...	7,354	...	(a)
Blood, dried ...	...	24,277	...	94,023	...	40,023	...	91,705	...	221,587
Bones, hoofs, and horns ...	...	1,013,351	...	845,255	...	733,798	...	777,357	...	1,067,911
Bristles—										
Crude, unsorted ... pounds..	13,435	9,389	11,620	5,325	7,710	7,620	10,129	7,637	37,927	12,987
Sorted, bunched, or prepared, pounds ...	2,728,114	2,686,357	3,433,941	3,256,552	2,614,783	2,090,157	2,884,372	2,583,482	3,992,520	3,111,872
Total bristles ... pounds..	2,741,549	2,695,746	3,445,561	3,261,877	2,622,493	2,097,777	2,894,501	2,591,119	4,030,447	3,124,859
Grease ...	...	1,295,855	...	1,355,739	...	1,103,081	...	1,489,764	...	1,522,327
Gut ...	...	85,587	...	103,489	...	113,861	...	128,165	...	149,103
Hair—b										
Horse ... pounds..	(a)	3,704,987	(a)	3,038,996	(a)	2,770,658	(a)	3,750,524	5,410,930	2,106,730
Other animal ... do....									13,349,752	1,065,061

Hide cuttings and other glue stock..		1,160,683		1,473,188		1,265,382		1,301,956		1,605,432
Hides and skins, other than furs—										
Calf skins..............pounds..	(c)	(c)	(c)	(c)	(c)	(c)	(c)	(c)	75,593,451	17,922,051
Cattle hides..............do....	156,155,300	21,862,060	134,671,020	20,649,258	98,353,249	12,044,435	192,252,083	23,795,602	318,003,538	46,700,139
Goatskins.................do....	111,079,391	31,773,909	101,201,596	31,715,298	63,640,758	17,325,126	104,048,244	26,023,914	115,844,758	30,837,590
Horse and ass skins.......do....	(c)	(c)	(c)	(c)	(c)	(c)	(c)	(c)	19,512,397	3,080,484
Sheepskins [d]..............do....	(c)	(c)	(c)	(c)	(c)	(c)	48,906,326	8,276,637	67,406,131	11,289,158
Other.....................do....	158,045,419	30,246,198	135,111,199	30,841,989	120,770,918	25,400,575	99,347,672	20,391,171	12,258,753	2,418,414
Total hides and skins....do....	425,280,110	83,882,167	370,983,815	83,206,545	282,764,925	54,770,136	444,554,325	78,487,324	608,619,028	112,247,836
Meat—										
Sausages, bologna...............	744,634	149,593	451,059	121,205	520,770	108,367	560,873	129,568	555,524	127,274
Other, including meat extracts..		675,568		888,209		775,713		667,367		1,086,966
Total meat.................		825,161		1,009,414		884,080		796,935		1,214,240
Oils.....................gallons..	160,854	23,914	132,843	26,671	85,964	16,965	(a)	(a)	(a)	(a)
Rennets..........................		93,288		117,344		151,028		97,684		92,459
Sausage casings..................		874,293		1,288,922		2,182,036		2,258,648		2,604,895
Stearin..................pounds..	1,700,177	134,196	1,184,287	93,385	1,434,845	135,739	3,895,254	411,485	8,144,485	952,628
Other............................		68,843		48,188		29,968		34,722		(e)
Total packing-house products.		95,906,263		95,974,871		66,299,437		92,224,742		127,975,068
Total animal matter..........		201,249,467		224,467,296		170,389,478		235,255,437		271,022,926
VEGETABLE MATTER.										
Argols, or wine lees............pounds..	28,140,835	2,358,061	30,540,893	2,562,384	26,738,834	2,305,185	32,115,646	2,641,867	28,182,956	2,220,687
Breadstuffs. (*See* Grain and grain products.)										
Broom corn.......................tons..	1	777	4	1,663	2	516	1,880	163,645	7,659	933,878
Cider..........................gallons..	13,644	15,013	8,018	7,842	9,764	11,113	9,704	10,298	7,791	7,606
Cocoa and chocolate:										
Cocoa—										
Crude, and leaves and shells of, pounds......................	80,117,402	8,697,515	92,249,819	13,376,562	82,831,242	14,257,250	129,854,749	14,850,328	108,668,070	11,376,061
Prepared, or manufactured, pounds......................	1,055,031	299,141	1,267,733	371,816	1,016,990	311,661	1,287,109	372,195	1,107,203	316,118
Total cocoa..........pounds..	81,172,433	8,996,656	93,517,552	13,748,378	83,848,232	14,568,911	131,141,858	15,222,523	109,775,273	11,692,179
Chocolate....................do....	2,954,594	702,717	3,541,961	830,611	2,756,452	715,131	1,519,073	339,795	1,295,561	274,247
Total cocoa and chocolate, pounds......................	84,127,027	9,699,373	97,059,513	14,578,989	86,604,684	15,284,012	132,660,931	15,562,318	111,070,834	11,966,426
Coffee.......................pounds..	851,668,933	73,256,134	985,321,473	78,231,902	890,640,057	67,688,106	1,049,868,768	79,112,129	871,469,516	69,194,353

[a] Not stated.
[b] Excluding human hair after July 1, 1909.
[c] Included in "Other" hides and skins other than furs.
[d] Except sheepskins with the wool on.
[e] Included in "Other, including meat extracts."

Agricultural imports of the United States during the five years ending June 30, 1910—Continued.

Article imported.	1906.		1907.		1908.		1909.		1910.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
VEGETABLE MATTER—continued.										
Coffee substitutes:										
Chickory root—										
Raw, unground........pounds..	3,401,065	$58,502	2,597,807	$41,680	2,170,633	$34,330	6,137,303	$99,389	2,595,942	$62,410
Roasted, ground, or otherwise prepared.............pounds..	546,809	20,560	615,267	25,770	502,792	21,311	644,466	24,947	288,866	11,618
Total chicory root......do....	3,947,874	79,062	3,213,074	67,450	2,673,425	55,641	6,781,769	124,336	2,884,808	74,028
Other........................do....	439,227	28,705	341,486	23,385	431,603	27,621	499,633	28,941	200,008	17,034
Total coffee substitutes.do....	4,387,101	107,767	3,554,560	90,835	3,105,028	83,262	7,281,402	153,277	3,084,816	91,062
Curry and curry powder	....	10,424	....	14,983	....	14,350	....	10,276	....	(a)
Fibers, vegetable:										
Cotton....................pounds..	70,963,633	10,879,592	104,791,784	19,930,988	71,072,855	14,172,241	86,518,024	13,622,802	86,037,691	15,816,138
Flax..........................tons..	8,729	2,327,300	8,656	2,254,112	9,528	2,514,680	9,870	2,512,256	12,761	3,536,062
Hemp........................do....	5,317	906,808	8,713	1,534,371	6,213	1,086,805	5,208	799,164	6,423	1,039,833
Istle, or Tampico fiber........do....	13,914	1,283,311	14,966	1,369,206	10,174	893,273	9,610	675,887	9,272	645,526
Jute and jute butts...........do....	103,945	6,419,684	104,489	8,950,918	107,533	6,504,920	156,685	7,216,307	68,155	3,728,448
Manila........................do....	58,738	11,036,667	54,513	10,876,107	52,467	8,974,617	61,902	7,156,091	93,253	10,517,100
New Zealand flax.............do....	(b)	(b)	(b)	(b)	(b)	(b)	(b)	(b)	3,353	362,888
Sisal grass....................do....	98,037	15,282,208	99,061	14,959,415	103,994	14,047,369	91,451	10,215,887	99,966	11,440,521
Other..........................do....	18,603	2,074,312	22,580	2,295,229	13,575	1,471,419	10,719	1,112,761	12,218	1,148,461
Total vegetables fibers.......	....	50,239,882	....	62,170,346	....	49,665,324	....	43,371,155	....	48,234,977
Flowers, natural........................	....	27,275	....	32,729	....	42,821	....	41,187	....	43,818
Forest products:										
Charcoal..................bushels..	774,501	$42,856	144,802	$8,516	472,670	$37,167	886,297	$46,660	(a)	(a)
Cinchona bark............pounds..	4,076,553	383,726	3,515,958	380,552	3,983,825	368,419	3,502,423	263,112	3,300,483	$242,087
Cork wood or cork bark............	....	1,837,134	....	2,356,052	....	2,092,732	....	2,016,551	....	3,152,280
Dyewoods, and extracts of—										
Dyewoods—										
Logwood.............tons..	37,313	496,551	38,230	478,636	21,594	244,460	17,874	166,371	32,368	368,448
Other.......................	....	109,515	....	54,902	....	55,940	....	45,760	....	(a)
Total dyewoods..............	....	606,066	....	533,538	....	300,400	....	212,131	....	368,448

Extracts and decoctions of, pounds	3,390,316	290,179	4,796,655	379,927	3,959,049	238,649	3,519,733	232,879	3,273,393	197,929
Total dyewoods and extracts of	....	896,245	....	913,465	....	539,049	....	445,010	....	566,377
Guayule plant............pounds..	(a)	(a)	1,187,596	24,613	1,524,401	28,583	945,789	18,490	1,146,193	33,462
Gums—										
Arabic....................do....	4,055,233	232,715	7,068,066	393,581	4,890,897	348,883	4,158,958	275,987	5,451,181	315,154
Camphor—										
Crude...............do....	1,668,744	608,440	3,138,070	1,572,863	2,814,299	1,365,269	1,990,499	602,530	3,026,648	921,926
Refined.............do....	(a)	(a)	(a)	(a)	(a)	(a)	451,362	158,297	477,269	179,965
Chicle...................do....	5,641,508	1,495,366	6,732,581	2,139,204	6,089,607	2,027,148	5,450,139	1,987,112	6,793,821	2,547,339
Copal, kauri, and damar, pounds	20,448,703	1,914,663	26,681,736	2,835,332	24,966,693	2,813,515	24,861,428	2,388,458	29,357,579	2,961,800
Gambier, or terra japonica, pounds	31,278,485	1,118,910	28,865,617	977,009	26,681,791	894,752	30,992,245	1,313,997	25,572,655	1,255,296
India rubber, gutta-percha, etc.—										
Balata.............pounds..	374,220	152,689	799,201	305,041	584,552	276,756	1,157,018	522,872	399,003	196,878
Gutta-joolatong, or East Indian gum......pounds..	21,390,116	733,074	28,437,660	1,085,098	22,803,303	1,039,776	24,826,296	852,372	52,392,444	2,419,223
Gutta-percha..........do....	500,770	188,161	546,890	201,339	188,610	100,305	255,559	82,136	784,501	167,873
India rubber..........do....	57,844,345	45,114,450	76,963,838	58,919,981	62,233,160	36,613,185	88,359,895	61,709,723	101,044,681	101,078,825
Total India rubber, etc., pounds	80,109,451	46,188,374	106,747,589	60,511,459	85,809,625	38,030,022	114,598,768	63,167,103	154,620,629	103,862,799
Shellac................pounds..	15,780,090	5,107,542	17,785,960	5,821,688	13,361,932	4,143,974	19,185,137	3,889,533	29,402,182	3,877,707
Other..........................	....	1,423,088	....	1,234,479	....	939,952	....	1,393,476	....	1,444,938
Total gums..................	....	58,089,098	....	75,485,615	....	50,563,515	....	75,176,493	....	117,366,924
Ivory, vegetable...........pounds..	21,076,508	516,607	16,602,229	464,931	14,536,288	375,535	20,002,909	609,062	27,066,716	1,104,924
Naval stores—										
Tar and pitch (of wood), barrels	1,363	6,504	1,330	6,928	2,523	9,797	1,018	5,150	(a)	(a)
Turpentine, spirits of..gallons..	158,730	59,273	35,386	16,110	76,743	29,210	51,137	17,538	127,090	54,330
Total naval stores............	....	65,777	....	23,038	....	39,007	....	22,688	....	54,330
Palm leaf, natural................	....	8,114	....	14,779	....	36,855	....	17,354	....	28,428
Tanning materials—										
Hemlock bark...........cords..	7,467	35,860	6,744	30,757	8,868	43,890	20,373	126,560	16,450	95,667
Mangrove bark...........tons..	....	(c)	20,693	426,431	15,192	310,745	12,263	250,409	16,089	402,853
Quebracho, extract of.pounds..	(a)	(a)	79,033,584	2,319,785	79,186,787	2,260,364	102,004,981	2,740,530	95,183,073	3,021,902
Quebracho wood..........tons..	....	(c)	66,810	840,779	48,871	612,971	66,113	731,795	80,210	1,058,647

a Not stated. b Included in "Other" vegetable fibers. c Included in "Other" tanning materials.

Agricultural imports of the United States during the five years ending June 30, 1910—Continued.

Article imported.	1906. Quantity.	1906. Value.	1907. Quantity.	1907. Value.	1908. Quantity.	1908. Value.	1909. Quantity.	1909. Value.	1910. Quantity.	1910. Value.
VEGETABLE MATTER—continued.										
Forest products—Continued.										
Tanning materials—Continued.										
Sumac, ground........pounds..	15,131,539	$237,309	12,487,103	$267,239	8,576,091	$227,611	10,974,613	$293,249	13,632,861	$299,170
Other........................	....	1,419,962	....	84,406	....	125,378	....	177,716	....	132,847
Total tanning materials.......	....	1,693,131	....	3,969,397	....	3,580,959	....	4,320,259	....	5,011,086
Wood, not elsewhere specified—										
Brier root or brier wood and ivy or laurel root..................	....	(a)	....	(a)	....	(a)	....	(a)	....	441,347
Chair cane or reed...............									....	246,475
Cabinet woods, unsawed—										
Cedar...............M feet..	....	(b)	....	(b)	....	(b)	....	(b)	19,294	1,028,588
Mahogany............do....	36,619	2,470,072	51,899	3,263,718	41,678	2,566,954	39,828	2,479,976	44,524	3,224,152
Other......................	....	1,334,748	....	2,091,882	....	1,464,907	....	1,406,318	....	721,084
Total cabinet woods.......	....	3,804,820	....	5,355,600	....	4,031,861	....	3,886,294	....	4,973,824
Logs and round timber. M feet..	100,592	773,260	97,573	938,501	131,348	1,264,439	155,095	1,510,767	177,490	1,746,472
Lumber—										
Boards, deals, planks, and other sawed lumber, M feet......................	949,717	14,813,733	934,195	16,255,350	791,288	15,212,788	846,024	15,946,755	1,054,416	19,372,215
Laths...................M..	....	(c)	....	(c)	....	(c)	....	(c)	722,423	1,804,139
Shingles..............do....	900,856	1,852,612	881,003	1,940,001	988,081	2,379,242	1,058,363	2,500,398	762,798	1,759,397
Other......................	....	2,700,505	....	2,764,015	....	2,665,428	....	2,452,888	....	1,185,153
Total lumber..........	....	19,366,850	....	20,959,366	....	20,257,458	....	20,900,041	....	24,120,904
Pulp wood..............cords..	....	(d)	650,366	2,792,751	923,503	4,989,919	727,104	4,333,905	1,000,342	6,392,023
Rattan and reeds..............	....	(d)	....	(d)	....	(d)	....	(d)	....	884,626
Timber, hewn, squared, or sided.............cubic feet..	256,180	46,770	....	2,384,743	....	2,214,268	....	1,724,177	....	738,214
All other.....................	....	4,353,034								
Total wood, n. e. s.......	....	28,344,734	....	32,430,961	....	32,757,945	....	32,355,184	....	39,543,885

Wood pulp—										
Chemical—										
Bleached..........pounds..	352,181,760	4,584,942	477,366,400	6,348,857	532,031,360	7,313,326	85,025,346	2,092,483	153,515,933	3,394,273
Unbleached..........do....							268,940,457	4,478,903	374,576,834	5,831,016
Mechanical..............do....							260,279,169	2,057,877	319,347,992	2,542,725
Total wood pulp........do....	352,181,760	4,584,942	477,366,400	6,348,857	532,031,360	7,313,326	614,244,972	8,629,263	847,440,759	11,768,014
Total forest products.........	....	96,462,364	....	122,420,776	....	97,733,092	....	123,920,126	....	178,871,797
Fruit juices, n. e. s.:										
Prune juice, or prune wine..gallons..	50,237	34,900	52,940	35,068	31,584	25,818	31,223	22,092	24,328	18,466
Other, including cherry juice.do....	40,893	24,661	54,553	35,662	40,467	26,677	31,703	20,734	38,392	27,042
Total fruit juices, n. e. s..do....	91,130	59,561	107,493	70,730	72,051	52,495	62,926	42,826	62,720	45,508
Fruits:										
Fresh or dried—										
Bananas.............bunches..	(e)	10,330,302	(e)	11,883,168	37,003,388	11,391,214	36,973,584	11,012,100	38,156,659	11,642,693
Currants..............pounds..	37,078,311	1,119,146	38,392,779	1,746,941	38,652,656	1,592,018	32,482,111	1,185,106	33,326,030	1,190,020
Dates..................do....	22,435,672	479,142	31,270,899	850,558	24,958,343	689,190	21,869,218	526,747	22,693,713	516,704
Figs...................do....	17,562,358	722,967	24,346,173	1,136,924	18,836,574	867,523	15,245,513	691,981	17,362,197	775,319
Grapes.............cubic feet..	....	(f)	1,298,469	1,575,521	2,234,508	2,743,356	1,203,419	1,575,620	1,365,310	1,682,994
Lemons..............pounds..	138,717,252	2,933,990	157,859,906	4,253,296	178,490,003	4,388,530	135,183,550	2,623,399	160,214,785	3,136,933
Olives.................gallons..	....	(f)	2,298,480	1,277,973	3,121,788	1,358,897	2,969,329	1,349,023	4,555,075	1,659,801
Oranges..............pounds..	31,134,341	456,726	21,267,346	354,495	18,397,429	275,080	8,435,873	137,390	4,676,118	82,457
Pineapples..................	....	(f)	....	(f)	....	(f)	....	(f)	....	1,317,462
Plums and prunes.....pounds..	497,494	53,348	323,377	45,386	335,089	49,322	296,123	41,696	....	(f)
Raisins..................do....	12,414,855	524,590	3,967,151	364,403	9,132,353	554,633	5,794,320	327,644	5,042,683	296,047
Other........................	....	2,484,345	....	1,363,167	....	2,250,813	....	1,912,949	....	920,362
Total fresh or dried..........	....	19,104,556	....	24,851,832	....	26,160,553	....	21,383,655	....	23,220,792
Prepared or preserved............	....	2,437,766	....	1,272,445	....	1,550,246	....	1,062,775	....	956,368
Total fruits................	....	21,542,322	....	26,124,277	....	27,710,799	....	22,446,430	....	24,177,160
Ginger, preserved or pickled...pounds..	365,255	19,516	472,190	29,810	409,331	27,189	523,360	34,665	527,721	27,585
Grain and grain products:										
Grain—										
Barley.................bushels..	18,049	9,803	38,319	14,033	199,741	143,407	2,644	1,440	....	(g)
Corn.......................do....	10,127	8,458	10,818	8,337	20,312	15,536	258,065	189,465	....	(g)
Oats.......................do....	22,675	10,726	74,552	26,634	364,307	179,714	6,666,989	2,651,699	1,034,511	400,920
Rye........................do....	5	4	158	126	17	16	51	51	....	(g)
Wheat......................do....	57,995	53,291	375,433	237,049	341,617	329,766	41,082	36,741	164,201	150,561
Total grain.............do....	108,851	82,282	499,280	286,179	925,994	668,439	6,968,831	2,879,396	1,198,712	551,481

a Included in "All other" wood.
b Included in "Other" cabinet woods, unsawed.
c Included in "Other" lumber.
d Included in "All other" unmanufactured woods.
e Not stated.
f Included in "Other" fresh or dried fruits.
g Included in "Other" grain products.

Agricultural imports of the United States during the five years ending June 30, 1910—Continued.

Article imported.	1906.		1907.		1908.		1909.		1910.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
VEGETABLE MATTER—continued.										
Grain and grain products—Continued.										
Grain products—										
Macaroni, vermicelli, etc., pounds	77,926,029	$2,941,204	87,720,730	$3,479,824	97,233,708	$4,009,995	85,114,003	$3,676,786	113,772,801	$4,926,812
Malt ... bushels	2,458	2,711	3,362	3,917	2,625	3,090	1,592	1,992	(a)	(a)
Meal and flour—										
Oatmeal ... pounds	312,306	16,625	301,266	15,581	344,003	19,876	444,801	24,612	...	(b)
Wheat flour ... barrels	45,314	177,239	47,702	159,046	39,593	179,295	92,413	446,500	144,759	681,944
Total meal and flour	...	193,864	...	174,627	...	199,171	...	471,112	...	681,944
Other	...	465,838	...	520,256	...	685,774	...	1,031,030	...	1,349,817
Total grain products	...	3,603,617	...	4,178,624	...	4,898,030	...	5,180,920	...	6,958,573
Total grain and grain products	...	3,685,899	...	4,464,803	...	5,566,469	...	8,060,316	...	7,510,054
Hay ... tons	68,540	502,051	61,116	501,507	10,063	89,808	6,712	60,854	96,829	775,916
Hops ... pounds	10,113,989	2,326,982	6,211,893	1,974,900	8,493,265	1,989,261	7,386,574	1,337,099	3,200,560	1,499,354
Indigo ... do	7,392,853	1,044,148	7,170,057	1,233,541	6,078,073	1,058,354	8,249,972	1,400,286	7,538,689	1,195,942
Licorice root ... do	102,151,969	1,661,454	66,115,863	1,140,541	109,355,720	1,864,436	97,742,776	1,628,894	82,207,496	1,365,077
Liquors, alcoholic:										
Distilled spirits—										
Of domestic manufacture, returned ... proof gallons	177,499	211,129	154,106	162,072	148,298	160,439	134,015	148,776	119,646	124,162
Brandy ... do	470,433	1,286,270	629,333	1,687,473	592,382	1,523,842	764,244	1,961,170	716,259	1,899,021
Gin ... do									1,240,662	1,015,035
Whisky ... do	2,639,680	4,027,368	3,270,226	5,037,146	3,216,228	4,876,325	3,889,066	5,566,879	1,060,300	2,167,064
Other ... do									1,245,308	1,907,941
Total distilled spirits, proof gallons	3,287,612	5,524,767	4,053,665	6,886,691	3,956,908	6,560,606	4,787,325	7,676,825	4,382,175	7,113,223
Malt liquors—										
Bottled ... gallons	1,582,619	1,466,228	2,041,688	1,902,655	1,960,333	1,829,917	1,801,043	1,695,747	1,727,541	1,605,919
Unbottled ... do	4,395,032	1,272,627	5,165,929	1,506,108	5,564,773	1,634,754	5,105,062	1,519,660	5,560,491	1,658,034
Total malt liquors ... do	5,977,651	2,738,855	7,207,617	3,408,763	7,525,106	3,464,671	6,906,105	3,215,407	7,288,032	3,263,953

Wines—										
Champagne and other sparkling..........dozen quarts..	415,394	6,127,062	419,403	6,228,281	366,669	5,221,070	436,628	6,863,785	391,022	6,302,702
Still wines—										
Bottled..................do....	546,688	2,299,194	636,938	2,614,346	628,428	2,516,461	650,861	2,574,596	822,266	3,177,140
Unbottled............gallons..	4,482,499	2,567,712	5,213,458	2,966,154	5,443,782	3,008,996	5,747,056	2,838,232	7,100,669	3,527,918
Total still wines..............	....	4,866,906	....	5,580,500	....	5,525,457	....	5,412,828	....	6,705,058
Total wines..................	....	10.993,968	....	11,808,781	....	10,746,527	....	12,276,613	....	13,007,760
Total alcoholic liquors.........	....	19,257,590	....	22,104,235	....	20,771,804	....	23,168,845	....	23,384,936
Malt, barley. (*See* Grain and grain products.)										
Malt extract, fluid or solid..............	....	2,473	....	3,163	....	21,227	....	4,450	....	(a)
Malt liquors. (*See* Liquors, alcoholic.)										
Meal, cotton-seed.............pounds..	661,505	4,991	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)
Nursery stock:										
Plants, trees, shrubs, and vines—										
Fruit plants, tropical and semi-tropical, for propagation, etc..	....	18,570	....	11,328	....	1,912	....	4,001	....	11,914
Orchids, palms, dracænas, crotons, azaleas, tulips, and other bulbs, bulbous roots or corms, cultivated for their flowers....	....	1,599,052	....	1,841,206	....	2,003,973	....	954,399	....	1,242,773
Other........................							....	988,507	....	1,106,977
Total nursery stock..........	....	1,617,622	....	1,852,534	....	2,005,885	....	1,946,907	....	2,361,664
Nuts:										
Almonds.................pounds..	15,009,326	1,825,475	14,233,613	2,331,816	17,144,968	2,410,648	11,029,421	1,852,523	18,556,356	3,153,645
Cocoanuts........................	....	1,298,740	....	1,349,562	....	1,439,770	....	1,252,594	....	1,295,854
Cocoanut meat, broken, or copra, pounds..........................	....	(c)	7,064,532	302,132	14,121,570	481,232	23,842,522	666,820	21,306,219	762,560
Cream and Brazil.........bushels..	....	(c)	252,538	650,488	310,420	754,155	407,719	761,219	461,496	1,251,738
Filberts..................pounds..	....	(c)	....	(c)	....	(c)	....	(c)	11,593,600	792,466
Palm, and palm nut kernels........	....	(c)	....	38,962	....	2,277	....	4,079	....	(c)
Peanuts.................pounds..	....	(c)	....	(c)	....	(c)	....	(c)	29,276,235	1,234,088
Walnuts....................do...	24,917,028	2,193,653	32,597,592	2,969,649	28,887,110	2,765,486	26,157,703	2,409,644	33,641,466	3,538,264
Other.........................	....	2,055,557	....	2,100,274	....	1,790,375	....	1,717,374	....	1,218,127
Total nuts.................	....	7,373,425	....	9,742,883	....	9,643,943	....	8,664,253	....	13,246,742
Oil cake...................pounds..	5,454,941	54,144	512,654	5,342	2,848,291	27,513	1,742,727	18,456	5,208,376	59,698

a Not stated. b Included in "Other" grain products. c Included in "Other" nuts.

Agricultural imports of the United States during the five years ending June 30, 1910—Continued.

Article imported.	1906.		1907.		1908.		1909.		1910.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
VEGETABLE MATTER—continued.										
Oils, vegetable:										
Fixed or expressed—										
Cocoa butter or butterine, pounds		(a)		(a)		(a)		(a)	3,369,528	$679,871
Cocoanut oil.......pounds		(a)	35,544,356	$2,623,974	45,422,575	$3,267,585	52,490,558	$3,079,682	48,345,672	3,341,409
Hemp and rape seed...gallons		(a)		(a)		(a)		(a)	1,082,775	464,742
Nut oil, or oil of nuts, n. e. s., gallons		(a)	2,453,597	1,040,722	1,869,120	882,983	2,912,965	1,158,132	5,759,683	2,440,010
Olive, for mechanical purposes, gallons	2,538,366	$1,105,876	1,471,766	682,656	1,565 253	703,829	369,979	183,983	842,926	477,679
Olive, salad.......gallons	2,447,131	2,566,994	3,449,517	3,523,725	3,799,112	3,876,901	4,129,454	5,069,655	3,702,210	4,869,114
Palm oil.......pounds		(a)	29,656,207	1,893,285	30,614,875	1,849,611	58,976,379	3,185,038	92,771,868	5,590,535
Other		6,015,403		1,925,300		1,788,150		1,945,080		2,952,273
Total fixed or expressed		9,688,273		11,689,662		12,369,059		14,621,570		20,815,633
Volatile or essential—										
Lemon.......pounds		2,863,005		3,702,220		3,645,441		2,932,512	415,501	309,383
Other										1,857,944
Total volatile or esssential		2,863,005		3,702,220		3,645,441		2,932,512		2,167,327
Total vegetable oils		12,551,278		15,391,882		16,014,500		17,554,082		22,982,960
Olive nuts, ground		6,899		(b)		(b)		(b)		(b)
Opium, crude.......pounds	469,387	1,143,683	565,252	1,482,649	285,845	1,151,207	517,388	1,951,518	449,239	1,622,475
Rice, rice meal, etc.:										
Rice.......do	58,468,791	1,465,487	71,287,151	2,118,147	87,619,202	2,543,417	88,780,442	2,361,310	82,662,162	2,112,032
Rice flour, rice meal, and broken rice.......pounds	108,079,166	1,616,716	138,316,029	2,273,999	125,164,190	2,255,136	134,119,980	2,336,723	142,738,383	2,249,205
Total rice, etc.......do	166,547,957	3,082,203	209,603,180	4,392,146	212,783,392	4,798,553	222,900,422	4,698,033	225,400,545	4,361,237
Sago, tapioca, etc.		830,479		1,432,082		1,574,835		1,396,090		990,525
Seeds:										
Castor beans or seeds.......bushels		(c)		(c)		(c)		(c)	726,002	831,056
Clover.......do		(c)	22,849,115	2,385,734	20,659,396	2,323,699	13,786,451	1,202,758	13,069,830	1,472,588
Flaxseed, or linseed.......do	52,240	73,423	90,356	124,494	57,419	71,625	593,668	831,871	5,002,496	8,548,837

Sugar beet..........pounds..	....	(c)	....	(c)	....	(c)	....	(c)	10,308,666	668,312
Other..........	....	5,314,620	....	3,894,548	....	3,976,146	....	3,923,390	....	3,172,983
Total seeds..........	....	5,388,043	....	6,404,776	....	6,371,470	....	5,958,019	....	14,693,776
Spices:										
Unground—										
Nutmegs..........pounds..	2,626,005	342,378	2,375,139	321,719	2,042,396	236,787	2,645,079	219,286	(d)	(d)
Pepper, black or white, pounds..........	26,535,834	2,733,137	24,320,865	2,232,774	20,335,693	1,532,901	37,094,824	2,115,413	15,488,848	1,102,104
Other..........pounds..	20,037,435	1,429,008	20,374,842	1,838,512	14,332,230	1,194,798	30,497,704	2,114,920	21,862,111	1,660,843
Total unground..........do....	49,199,274	4,504,523	47,070,846	4,393,005	36,710,319	2,964,486	70,237,607	4,449,619	37,350,959	2,762,947
Ground..........do....	7,047,685	683,593	6,490,048	719,995	5,414,493	627,051	7,964,336	898,987	6,442,199	720,512
Total spices..........do....	56,246,959	5,188,116	53,560,894	5,113,000	42,124,812	3,591,537	78,201,943	5,348,606	43,793,158	3,483,459
Spirits, distilled. (*See* Liquors, alcoholic.)										
Starch..........pounds..	5,422,267	156,176	6,330,493	152,020	5,284,050	138,166	17,301,351	424,089	10,861,310	296,030
Straw and grass..........tons..	4,317	16,539	1,497	6,147	1,462	7,659	2,054	12,098	6,762	32,367
Sugar and molasses:										
Molasses..........gallons..	16,021,076	690,718	24,630,935	919,806	18,882,756	721,867	22,092,696	937,791	31,292,165	1,367,362
Sugar—										
Raw—										
Beet..........pounds..	48,548,919	1,032,040	397,745,046	8,203,309	221,036,900	5,401,378	98,625,908	2,521,798	1,148	43
Cane..........do....	3,921,605,729	84,066,863	3,986,510,021	84,273,071	3,144,022,423	74,509,970	4,084,921,078	93,768,598	4,088,437,524	106,075,846
Total raw..........do....	3,970,154,648	85,098,903	4,384,255,067	92,476,380	3,365,059,323	79,911,348	4,183,546,986	96,290,396	4,088,438,672	106,075,889
Refined..........do....	9,176,782	361,185	7,584,908	329,873	6,937,789	346,799	5,874,032	264,602	6,107,264	273,116
Total sugar..........do....	3,979,331,430	85,460,088	4,391,839,975	92,806,253	3,371,997,112	80,258,147	4,189,421,018	96,554,998	4,094,545,936	106,349,005
Total sugar and molasses..	....	86,150,806	....	93,726,059	....	80,980,014	....	97,492,789	....	107,716,367
Sugar-beet pulp..........pounds..	(b)	(b)	(b)	(b)	(b)	(b)	1,556,467	12,871	3,405,500	27,228
Tea..........do....	93,621,750	14,580,878	86,368,490	13,915,544	94,149,564	16,309,870	114,916,520	18,562,676	85,626,370	13,671,946
Tea, waste, etc., for manufacturing, pounds..........	(b)	(b)	(b)	(b)	(b)	(b)	1,920,918	59,317	3,229,221	96,122
Teazels..........	....	10,169	....	9,756	....	10,509	....	8,412	....	(b)
Tobacco:										
Leaf—										
Wrapper..........pounds..	6,732,774	6,475,226	7,576,325	8,617,575	5,943,714	6,312,023	5,648,178	5,342,634	6,647,948	6,483,555
Filler and other leaf.......do....	30,622,703	15,972,288	31,963,996	17,437,673	26,112,329	16,558,305	36,087,920	20,058,285	40,205,441	21,270,003
Stems..........do....	3,770,493	15,954	1,358,486	4,737	2,949,088	14,203	1,387,098	4,854	(b)	(b)
Total tobacco..........do....	41,125,970	22,463,468	40,898,807	26,059,985	35,005,131	22,884,531	43,123,196	25,405,773	46,853,389	27,753,558

a Included in "Other" vegetable oils, fixed or expressed. b Not stated. c Included in "Other" seeds. d Included in "Other" unground spices.

Agricultural imports of the United States during the five years ending June 30, 1910—Continued.

Article imported.	1906.		1907.		1908.		1909.		1910.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
VEGETABLE MATTER—continued.										
Vanilla beans.....pounds..	852,505	$1,321,550	969,249	$1,523,156	571,977	$1,170,135	1,121,485	$1,495,469	797,409	$1,203,773
Vegetables:										
Fresh or dried—										
Beans and dried pease.bushels..	458,041	667,214	406,679	656,898	1,657,401	2,406,935	3,355,405	4,926,199	1,015,157	1,621,207
Onions.....do....	872,566	615,584	1,126,114	926,115	1,275,333	866,663	574,530	412,127	1,024,226	769,539
Potatoes.....do....	1,948,160	853,063	176,917	192,635	403,952	283,032	8,383,966	3,677,034	353,208	306,815
Other.....	.....	815,068	.....	1,024,262	.....	1,138,429	.....	1,104,036	.....	1,857,846
Total fresh or dried.....	.....	2,950,929	.....	2,799,910	.....	4,695,059	.....	10,119,396	.....	4,555,407
Prepared or preserved—										
Mushrooms.....pounds..	.....	(a)	.....	(a)	.....	(a)	.....	(a)	7,038,127	940,382
Pickles and sauces.....	.....	706,050	.....	934,803	.....	816,245	.....	796,842	.....	935,609
Other.....	.....	1,435,953	.....	1,993,759	.....	2,777,764	.....	2,083,559	.....	1,841,973
Total prepared or preserved...	.....	2,142,003	.....	2,928,562	.....	3,594,009	.....	2,880,401	.....	3,717,964
Total vegetables.....	.....	5,092,932	.....	5,728,472	.....	8,289,068	.....	12,999,797	.....	8,273,371
Vinegar.....gallons..	198,591	49,319	230,072	65,282	204,213	56,671	280,033	71,867	301,030	78,577
Wafers, unmedicated.....	.....	26,353	.....	26,617	.....	28,016	.....	25,316	.....	36,922
Wax, vegetable.....pounds..	(b)	(b)	(b)	(b)	(b)	(b)	(b)	(b)	5,241,087	823,053
Wines. (*See* Liquors, alcoholic.)										
Total vegetable matter, including forest products.....	.....	449,388,139	.....	524,790,288	.....	467,033,735	.....	527,277,381	.....	595,357,986
Total vegetable matter, excluding forest products.....	.....	352,925,775	.....	402,369,512	.....	369,300,643	.....	403,357,255	.....	416,486,189
Total agricultural imports, including forest products.....	.....	650,637,606	.....	749,257,584	.....	637,423,213	.....	762,532,818	.....	866,380,912
Total agricultural imports, excluding forest products.....	.....	554,175,242	.....	626,836,808	.....	539,690,121	.....	638,612,692	.....	687,509,115

[a] Included in "Other" vegetables, prepared or preserved.

[b] Not stated.

Agricultural exports (domestic) of the United States during the five years ending June 30, 1910.

Articles exported.	1906.		1907.		1908.		1909.		1910.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
ANIMAL MATTER.										
Animals, live:										
Cattle......number..	584,239	$42,081,170	423,051	$34,577,392	349,210	$29,339,134	207,542	$18,046,976	139,430	$12,200,154
Fowls......	......	(a)	......	(a)	......	151,925	......	115,946	......	137,619
Horses......number..	40,087	4,365,981	33,882	4,359,957	19,000	2,612,587	21,616	3,386,617	28,910	4,081,157
Mules......do....	7,167	989,639	6,781	850,901	6,609	990,667	3,432	472,017	4,512	614,094
Sheep......do....	142,690	804,090	135,344	750,242	101,000	589,285	67,656	365,155	44,517	209,000
Swine......do....	59,170	630,998	24,262	309,440	30,818	307,202	18,655	144,605	4,410	46,955
Other [b]......	......	267,690	......	355,148	......	110,489	......	114,122	......	158,756
Total live animals......	......	49,139,568	......	41,203,080	......	34,101,289	......	22,645,438	......	17,447,735
Beeswax......pounds..	101,726	29,894	117,169	36,392	90,506	28,659	77,547	23,293	89,890	27,740
Dairy products:										
Butter......do....	27,360,537	4,922,913	12,544,777	2,429,489	6,463,061	1,407,962	5,981,265	1,268,210	3,140,545	785,771
Cheese......do....	16,562,451	1,940,620	17,285,230	2,012,626	8,439,031	1,092,053	6,822,842	857,091	2,846,709	441,017
Milk......do....	(c)	1,889,690	(c)	2,191,111	(c)	2,455,186	(c)	1,375,104	13,311,318	1,023,633
Total dairy products....do....	(c)	8,753,223	(c)	6,633,226	(c)	4,955,201	(c)	3,500,405	19,298,572	2,250,421
Eggs......dozens..	4,952,063	1,038,649	6,968,985	1,542,789	7,590,977	1,540,014	5,207,151	1,199,522	5,325,936	1,260,486
Egg yolks......	......	54,851	......	11,565	......	9,024	......	23,938	......	3,585
Feathers......	......	263,377	......	316,306	......	389,556	......	400,045	......	312,784
Fibers, animal:										
Silk waste......pounds..	71,368	13,781	129,078	37,709	198,736	49,881	300,553	77,944	266,207	64,528
Wool......do....	192,481	29,095	214,840	48,820	182,458	42,104	28,376	4,668	47,520	10,077
Total animal fibers.....do....	263,849	42,876	343,918	86,529	381,194	91,985	328,929	82,612	313,727	74,605
Glue......do....	3,157,837	298,796	3,481,715	331,998	2,917,173	289,441	2,340,426	244,751	2,488,205	261,756
Honey......	......	111,945	......	93,690	......	78,102	......	85,578	......	159,401

a Included in "Other" live animals. b Including "Fowls" prior to July 1, 1907. c Not stated.

Agricultural exports (domestic) of the United States during the five years ending June 30, 1910—Continued.

Article exported.	1906.		1907.		1908.		1909.		1910.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
ANIMAL MATTER—continued.										
Packing-house products:										
Beef—										
Canned .... pounds..	64,523,359	$6,430,446	15,809,826	$1,615,808	23,376,447	$2,467,875	14,895,527	$1,645,822	14,804,596	$1,678,452
Cured—										
Salted or pickled ..... do....	81,088,098	4,697,742	62,645,281	3,740,212	46,958,367	3,213,480	44,494,210	3,438,048	36,554,266	2,744,886
Other .... do....	199,483	22,063	1,053,287	107,956	937,720	106,470	294,853	34,319	317,047	38,815
Total cured .... do....	81,287,581	4,719,805	63,698,568	3,848,168	47,896,087	3,319,950	44,789,063	3,472,367	36,871,313	2,783,701
Fresh .... do....	268,054,227	24,310,038	281,651,502	26,367,287	201,154,105	20,339,377	122,952,671	12,698,594	75,729,666	7,733,751
Oils—Oleo oil and neutral lard, ... pounds..	209,658,075	17,455,976	195,337,176	16,819,933	212,541,157	19,278,476	179,985,246	19,126,741	126,091,675	14,305,080
Oleomargarine .... do....	11,794,174	1,033,256	5,397,609	520,406	2,938,175	299,746	2,889,058	293,635	3,418,632	349,972
Tallow .... do....	97,567,156	4,791,025	127,857,739	7,182,688	91,397,507	5,399,219	53,332,767	3,000,366	29,379,992	1,779,615
Total beef .... do....	732,884,572	58,740,546	689,752,420	56,354,290	579,303,478	51,104,643	418,844,332	40,237,525	286,295,874	28,030,571
Bones, hoofs, horns, and horn tips, strips and waste	....	212,516	....	172,208	....	245,628	....	232,628	....	150,371
Bristles	....	329	....	2,732	....	410	....	(a)	....	(a)
Grease, grease scraps, and all soap stock	....	4,138,333	....	5,473,623	....	5,762,709	....	4,814,901	....	4,612,426
Hair	....	854,038	....	938,433	....	1,165,475	....	988,749	....	1,142,845
Hides and skins, other than furs, ... pounds..	10,752,827	1,223,255	15,396,806	1,760,032	14,650,454	1,536,225	12,858,975	1,271,190	14,635,075	1,738,216
Lard compounds .... do....	67,621,310	4,154,183	80,148,861	6,166,910	75,183,210	6,035,418	75,183,196	6,115,307	74,556,603	6,887,738
Meat, canned, n. e. s	....	1,593,497	....	745,247	....	1,265,283	....	1,060,222	....	1,030,031
Mutton .... pounds..	516,345	51,163	822,998	83,874	1,185,040	117,688	1,498,674	141,654	1,989,472	213,477
Oils, animal, n. e. s .... gallons..	338,687	224,991	503,234	292,381	621,300	341,304	614,383	343,838	535,875	401,460
Pork—										
Canned .... pounds..	12,699,800	1,215,857	2,710,369	287,460	4,957,022	532,442	5,759,930	620,193	4,062,022	459,843
Cured—										
Bacon .... do....	361,210,563	35,845,793	250,418,699	26,470,972	241,189,929	25,481,246	244,578,674	25,920,490	152,163,107	18,381,050
Hams and shoulders.. do....	194,267,949	20,075,511	209,481,496	23,698,207	221,769,634	25,167,059	212,170,224	23,526,307	146,885,385	17,837,375
Salted or pickled ..... do....	141,820,720	11,681,634	166,427,409	15,167,058	149,505,937	13,332,654	52,354,980	4,599,431	40,031,599	4,421,844
Total cured .... do....	697,299,232	67,602,938	626,327,604	65,336,237	612,465,500	63,980,959	509,103,878	54,046,228	339,080,091	40,640,269

Fresh ... do	13,444,438	1,261,412	11,467,779	1,143,886	16,374,468	1,551,450	9,555,315	938,025	1,040,278	126,888
Lard ... do	741,516,886	60,132,091	627,559,660	57,497,980	603,413,770	54,789,748	528,722,933	52,712,569	362,927,671	43,301,156
Oils—Lard oil ... gallons	298,103	180,474	234,730	144,063	259,062	169,625	234,626	167,644	151,142	131,241
Total pork	...	130,392,772	...	124,409,626	...	121,024,224	...	108,484,659	...	84,659,397
Sausage and sausage meat ... pounds	7,926,786	881,686	8,000,973	925,877	8,367,495	969,472	8,538,058	997,655	5,072,255	627,669
Sausage casings ... do	(a)	2,572,479	(a)	3,422,271	(a)	3,959,384	(a)	3,520,191	35,418,957	4,503,339
All other	...	2,633,986	...	2,708,632	...	2,659,228	...	1,783,331	...	1,361,833
Total packing-house products	...	207,673,774	...	203,456,136	...	196,187,091	...	169,991,850	...	135,959,373
Poultry and game	...	1,397,004	...	1,086,618	...	881,792	...	848,644	...	599,548
Quills	...	150	...	(a)	...	(a)	...	(a)	...	(a)
Silk waste. (*See* Fibers, animal.)										
Wool. (*See* Fibers, animal.)										
Total animal matter	...	268,804,107	...	254,798,329	...	238,552,154	...	199,046,076	...	158,357,434
VEGETABLE MATTER.										
Breadstuffs. (*See* Grain and grain products.)										
Broom corn	...	240,164	...	268,812	...	266,696	...	304,522	...	424,484
Cider ... gallons	344,117	53,577	197,514	30,681	172,617	26,401	87,630	14,121	5,784	1,965
Cocoa, ground or prepared, and chocolate	...	349,107	...	376,467	...	403,509	...	471,458	...	471,358
Coffee:										
Green or raw ... pounds	28,346,323	3,483,238	38,771,906	4,692,137	35,356,109	4,314,020	28,630,278	3,729,840	45,514,438	5,703,786
Roasted or prepared ... do	838,181	117,749	2,261,517	297,280	4,301,029	474,451	986,100	155,776	1,210,886	196,348
Total coffee ... do	29,184,504	3,600,987	41,033,423	4,989,417	39,657,138	4,788,471	29,616,378	3,885,616	46,725,324	5,900,134
Cotton:										
Sea Island ... bales	42,271	3,335,022	20,173	2,075,446	33,042	3,351,132	25,939	2,035,120	30,201	3,276,441
Sea Island ... pounds	16,245,924		7,605,804		12,699,567		9,740,806		11,460,277	
Upland ... bales	7,008,085	397,670,899	8,688,296	479,202,351	7,401,538	434,437,070	8,551,789	415,355,545	6,233,092	447,170,802
Upland ... pounds	3,617,799,246		4,510,611,416		3,804,299,126		4,438,244,396		3,195,247,949	
Total cotton ... do	3,634,045,170	401,005,921	4,518,217,220	481,277,797	3,816,998,693	437,788,202	4,447,985,202	417,390,665	3,206,708,226	450,447,243
Flavoring extracts and fruit juices	...	52,490	...	48,491	...	52,395	...	64,418	...	84,856
Flowers, cut	...	3,496	...	2,579	...	1,784	...	4,433	...	10,585
Forest products:										
Bark, and extract of, for tanning—										
Bark ... pounds	4,873,237	75,084	2,322,130	29,975	3,987,330	57,515	3,845,690	56,572	1,210,305	18,291
Bark, extracts of	...	356,847	...	305,998	...	241,608	...	260,965	...	388,448
Total bark, etc	...	431,931	...	335,973	...	299,123	...	317,537	...	406,739

a Not stated.

Agricultural exports (domestic) of the United States during the five years ending June 30, 1910—Continued.

Article exported.	1906. Quantity.	1906. Value.	1907. Quantity.	1907. Value.	1908. Quantity.	1908. Value.	1909. Quantity.	1909. Value.	1910. Quantity.	1910. Value.
VEGETABLE MATTER—continued.										
Forest products—Continued.										
Charcoal		$14,727		$7,956		$4,271		$13,360		$25,310
Moss		37,201		40,578		33,742		39,284		41,243
Naval stores—										
Rosin ... barrels	2,438,556	9,899,080	2,560,966	11,327,091	2,712,732	11,395,126	2,170,177	8,004,838	2,144,318	9,753,488
Tar ... do	16,821	55,362	16,792	57,215	14,691	53,983	11,072	46,442	40,037	148,238
Turpentine and pitch ... do	14,232	43,875	19,830	60,563	13,448	46,339	10,034	31,809		
Turpentine, spirits of ... gallons	15,981,253	10,077,268	15,854,676	10,241,883	19,532,583	10,146,151	17,502,028	7,018,058	15,587,737	8,780,236
Total naval stores		20,075,585		21,686,752		21,641,599		15,101,147		18,681,962
Wood—										
Logs[a]		3,866,300		3,645,180		4,337,766		2,846,863		3,432,635
Lumber—										
Boards, deals, and planks, M feet	1,344,607	28,695,823	1,623,964	39,861,352	1,548,130	35,607,508	1,357,822	29,056,579	1,684,489	36,774,219
Joists and scantling . M feet	29,119	501,711	34,851	752,152	27,332	581,718	22,122	378,914	26,272	507,853
Shingles ... M	26,272	73,635	18,256	53,261	20,483	75,535	14,104	61,784	17,292	53,371
Shooks—										
Box		954,268		939,724		958,127		957,682		1,121,613
Other ... number	1,066,253	1,524,549	803,346	1,409,595	900,812	1,716,190	977,376	1,962,199	928,197	1,654,611
Total shooks		2,478,817		2,349,319		2,674,317		2,919,881		2,776,224
Staves and heading—										
Heading		201,219		157,553		176,430		154,766		223,038
Staves ... number	57,586,378	4,699,877	51,120,171	5,127,522	61,696,949	6,016,690	52,583,016	5,524,199	49,783,771	4,673,085
Total staves and heading		4,901,096		5,285,075		6,193,120		5,678,965		4,896,123
Other		3,317,164		3,578,452		5,216,854		5,461,866		5,355,245
Total lumber		39,968,246		51,879,611		50,349,052		43,557,989		50,363,035

Timber—										
Hewn............cubic feet..	3,517,046	877,786	3,278,110	890,106	4,883,506	1,316,465	2,950,528	839,011	3,245,196	825,192
Sawed..............M feet..	552,548	10,649,310	600,865	13,101,178	463,440	11,040,677	383,309	8,414,519	451,721	9,852,027
Total timber..............		11,527,096		13,991,284		12,357,142		9,253,530		10,677,219
All other, including firewood....		(b)		(b)		(b)		479,996		460,210
Total wood..................		55,361,642		69,516,075		67,043,960		56,138,378		64,933,099
Wood alcohol...............proof galls..	780,222	466,467	2,150,311	862,819	1,958,630	819,753	1,100,495	383,788	1,328,601	581,820
Wood pulp....................pounds.	29,482,434	587,878	25,079,946	498,552	23,845,732	519,625	20,650,756	448,960	17,297,389	360,057
Total forest products..........		76,975,431		92,948,705		90,362,073		72,442,454		85,030,230
Fruits:										
Fresh or dried—										
Apples, dried..........pounds..	27,852,831	2,044,820	45,697,948	3,166,946	24,237,873	1,946,810	33,474,634	2,339,936	25,076,618	2,056,292
Apples, fresh...........barrels..	1,208,989	3,751,375	1,539,267	4,652,966	1,049,545	3,660,854	896,279	2,782,007	922,078	3,175,133
Apricots, dried........pounds..	13,760,281	1,325,422	2,760,432	336,812	1,224,602	229,467	16,597,871	1,512,417	12,028,834	1,218,423
Oranges..................boxes..	(c)	1,110,993	(c)	1,255,164	654,251	1,577,661	866,753	2,131,724	932,118	2,213,965
Peaches, dried.........pounds..	1,181,649	110,407	1,757,650	186,013	1,148,598	114,318	2,403,430	151,334	2,617,069	151,520
Pears, fresh........................		631,972		675,914		288,918		546,198		302,958
Prunes.................pounds..	24,869,744	1,410,636	44,400,104	2,400,960	28,148,450	1,612,114	22,602,288	1,078,210	89,014,880	4,016,554
Raisins..................do....	4,528,502	305,768	9,128,827	599,398	5,684,541	427,583	7,880,161	455,657	8,526,114	417,403
Other..........................		1,727,943		2,246,384		2,390,360		2,104,624		2,119,210
Total fresh or dried...........		12,419,336		15,520,557		12,278,085		13,102,107		15,672,098
Preserved—										
Canned..........................		2,348,064		1,581,047		1,549,826		2,899,374		2,656,019
Other..............................		89,872		104,663		137,929		77,746		176,474
Total preserved..............		2,437,936		1,685,710		1,687,755		2,977,120		2,832,493
Total fruits.................		14,857,272		17,206,267		13,965,840		16,079,227		18,504,591
Ginseng.......................pounds..	160,949	1,175,844	117,696	813,023	154,180	1,111,994	186,257	1,270,179	192,406	1,439,434
Glucose and grape sugar:										
Glucose......................do....	189,656,011	3,489,192	151,629,441	3,017,527	98,608,192	1,898,652	92,652,409	1,938,406	112,730,639	2,623,131
Grape sugar.................do....					31,078,642	641,988	19,572,095	407,683	37,089,449	792,089
Grain and grain products:										
Grain—										
Barley................bushels..	17,729,360	8,653,231	8,238,842	4,556,295	4,349,078	3,205,528	6,580,393	4,672,166	4,311,566	3,052,527
Buckwheat..............do....	696,513	449,129	199,429	128,837	116,127	94,638	186,702	137,413	158,160	103,138
Corn.........................do....	117,718,657	62,061,856	83,300,708	44,261,816	52,445,800	33,942,197	35,853,412	25,194,466	36,802,374	25,427,993
Oats.........................do....	46,324,935	16,234,918	4,014,042	1,670,881	1,158,622	624,569	1,510,320	804,759	1,685,474	794,367
Rye..........................do....	1,355,528	905,350	749,455	562,016	2,419,958	2,184,335	1,272,559	1,049,809	219,756	168,666
Wheat.......................do....	34,973,291	28,757,517	76,569,423	60,214,388	100,371,057	99,736,767	66,923,244	68,094,447	46,679,876	47,806,598
Total grain......... ..do....	218,798,284	117,062,001	173,071,899	111,394,233	160,860,642	139,788,034	112,326,630	99,953,060	89,857,206	77,353,289

a Prior to July 1, 1908, including firewood and other unmanufactured wood. b Included in "Logs." c Not stated.

Agricultural exports (domestic) of the United States during the five years ending June 30, 1910—Continued.

Article exported.	1906.		1907.		1908.		1909.		1910.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
VEGETABLE MATTER—continued.										
Grain and grain products—Continued.										
Grain products—										
Bran, middlings, and mill feed, tons	99,418	$2,052,285	92,675	$2,115,848	116,917	$3,004,174	45,737	$1,222,406	53,548	$1,521,622
Breadstuff preparations—										
Bread and biscuit ..pounds..	11,193,643	660,252	11,886,745	696,025	13,052,074	766,170	12,606,614	710,687	13,064,688	767,151
Other		2,208,585		1,942,238		1,885,915		1,858,646		2,040,314
Total breadstuff preparations		2,868,837		2,638,263		2,652,085		2,569,333		2,807,465
Distillers' and brewers' grains and malt sprouts.......tons..	102,683	1,937,315	84,581	1,617,850	65,682	1,424,677	75,503	1,758,404	65,497	1,640,401
Malt.................bushels..	881,523	598,453	414,515	278,448	224,991	201,554	163,230	147,258	156,497	129,088
Meal and flour—										
Corn meal..........barrels..	543,794	1,623,397	766,880	2,313,410	654,515	2,053,447	452,907	1,549,010	331,531	1,147,568
Oatmeal...........pounds..	37,972,903	948,088	42,701,257	1,122,162	24,484,199	705,853	14,822,944	516,524	15,538,535	521,658
Rye flour..........barrels..	5,383	20,019	3,377	10,879	4,105	16,521	3,857	14,600	3,751	15,240
Wheat flour..........do....	13,919,048	59,106,869	15,584,667	62,175,397	13,927,247	64,170,508	10,521,161	51,157,366	9,040,987	47,621,467
Total meal and flour		61,698,373		65,621,848		66,946,329		53,237,500		49,305,933
All other		850,090		732,660		1,445,289		1,188,518		562,620
Total grain products		70,005,353		73,004,917		75,674,108		60,123,419		55,967,129
Total grain and grain products		187,067,354		184,399,150		215,462,142		160,076,479		133,320,418
Grasses, dried		9,805		11,670		1,206		(a)		(a)
Hay..........................tons..	70,172	1,116,307	58,602	976,287	77,281	1,463,010	64,641	1,147,753	55,007	1,070,907
Hops........................pounds..	13,026,904	3,125,843	16,809,534	3,531,972	22,920,480	2,963,167	10,446,884	1,271,629	10,589,254	2,062,140
Lard compounds. (*See* Meat and meat products.)										
Liquors, alcoholic:										
Distilled spirits—										
Alcohol, including cologne spirits..........proof gallons..	504,665	103,833	428,107	70,814	235,752	53,793	103,932	36,719	231,077	64,393

Brandy ....do....	5,145	8,553	14,172	22,496	2,750	4,900	14,718	12,262	(b)	(b)
Rum ....do....	701,423	877,922	914,074	1,191,418	938,331	1,232,179	926,049	1,237,118	1,138,128	1,474,761
Whisky—										
Bourbon ....do....	183,621	245,264	190,067	253,222	129,258	160,914	331,909	365,446	46,301	80,213
Rye ....do....	109,522	207,783	134,110	252,918	172,755	320,935	121,320	210,031	182,002	301,044
Total whisky ....do....	293,143	453,047	324,177	506,140	302,013	481,849	453,229	575,477	228,303	381,257
Other ....do....	40,089	81,870	19,779	36,889	28,391	43,566	11,204	22,391	38,122	57,595
Total distilled spirits ....do....	1,544,465	1,525,225	1,700,309	1,827,757	1,507,237	1,816,287	1,509,132	1,883,967	1,635,630	1,978,006
Malt liquors—										
Bottled ....dozen quarts..	727,731	1,059,584	743,163	1,128,226	643,230	964,207	635,361	964,992	596,883	877,324
Unbottled ....gallons..	256,575	57,192	356,788	87,114	272,949	55,965	246,525	45,795	390,477	73,859
Total malt liquors	....	1,116,776	....	1,215,340	....	1,020,172	....	1,010,787	....	951,183
Wines—										
Bottled ....dozen quarts..	5,596	25,215	4,404	20,128	6,273	30,830	3,839	19,902	5,962	31,314
Unbottled ....gallons..	789,526	326,335	560,147	251,353	438,676	195,160	415,891	181,516	501,348	193,597
Total wines	....	351,550	....	271,481	....	225,990	....	201,418	....	224,911
Total alcoholic liquors	....	2,993,551	....	3,314,578	....	3,062,449	....	3,096,172	....	3,154,100
Malt. (*See* Grain and grain products.)										
Malt liquors. (*See* Liquors, alcoholic.)										
Malt sprouts. (*See* Grain and grain products.)										
Nursery stock	....	242,056	....	225,339	....	247,844	....	317,827	....	324,136
Nuts:										
Peanuts ....pounds..	7,180,163	275,927	6,386,012	278,236	5,503,685	283,819	5,501,107	242,569	4,484,613	224,779
Other	....	140,959	....	103,929	....	89,205	....	246,284	....	156,284
Total nuts	....	416,886	....	382,165	....	373,024	....	488,853	....	381,063
Oil cake and oil-cake meal:										
Corn ....pounds..	48,420,942	605,346	56,808,972	677,156	66,127,704	801,787	53,233,890	727,355	49,108,598	689,633
Cotton seed ....do....	1,110,834,678	13,073,100	1,340,967,136	17,062,594	929,287,467	11,889,415	1,233,750,327	15,805,433	640,088,766	9,071,815
Flaxseed, or linseed ....do....	758,916,364	10,313,118	665,936,164	8,675,877	696,135,362	9,175,559	682,764,545	9,303,346	652,316,916	9,489,564
Total	1,918,171,984	23,991,564	2,063,712,272	26,415,627	1,691,550,533	21,866,761	1,969,748,762	25,836,134	1,341,514,280	19,251,012
Oils, vegetable:										
Fixed or expressed—										
Corn ....pounds..	28,749,382	1,172,206	22,809,517	1,083,929	27,444,975	1,456,120	24,441,668	1,293,580	11,299,332	643,392
Cotton-seed ....do....	328,451,393	13,673,370	314,102,280	17,074,403	307,649,933	17,226,451	383,154,968	20,851,380	223,955,002	14,798,063
Linseed ....gallons..	312,766	150,395	450,208	203,712	367,883	172,083	273,029	140,876	228,426	155,858
Other	....	244,267	....	430,965	....	206,993	....	249,360	....	343,509
Total fixed or expressed	....	15,240,238	....	18,793,009	....	19,061,647	....	22,535,196	....	15,940,822

a Not stated.

b Included in "Other," distilled spirits.

Agricultural exports (domestic) of the United States during the five years ending June 30, 1910—Continued.

Article exported.	1906.		1907.		1908.		1909.		1910.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
VEGETABLE MATTER—continued.										
Oils, vegetable—Continued.										
Volatile, or essential—										
Peppermint .... pounds..	74,151	$206,261	147,722	$499,082	141,617	$357,555	161,811	$288,318	110,407	$215,845
Other		459,532		258,423		214,765		274,536		322,634
Total volatile, or essential		665,793		757,505		572,320		562,854		538,479
Total vegetable oils		15,906,031		19,550,514		19,633,967		23,098,050		16,479,301
Rice, rice meal, etc.:										
Rice .... pounds..	3,969,722	138,853	2,443,008	84,681	2,195,947	87,687	1,566,531	60,814	7,049,597	222,244
Rice bran, meal, and polish, pounds	34,172,331	255,265	27,731,363	259,521	26,248,468	236,070	18,944,898	171,589	19,729,591	179,037
Rice hulls		101,754		113,071		150,011		119,279		73,249
Total .... pounds..		495,872		457,273		473,768		351,682		474,530
Root beer .... dozen quarts..	3,276	3,615	1,756	1,846	330	441	(a)	(a)	(a)	(a)
Roots, herbs, and barks, n. e. s.		364,411		413,799		435,041		395,801		476,837
Seeds:										
Cottonseed .... pounds..	23,717,326	268,330	17,628,111	209,493	28,478,473	353,213	51,626,741	632,561	24,931,099	406,120
Flaxseed, or linseed .... bushels..	5,988,519	7,495,748	6,336,310	7,990,383	4,277,313	5,721,337	882,899	1,092,539	65,193	118,329
Grass and clover seed—										
Clover .... pounds..	2,265,760	267,258	3,989,798	420,104	3,547,747	579,199	16,186,133	1,706,780	6,977,685	832,676
Timothy .... do....	11,247,080	385,454	18,616,834	813,224	25,550,134	1,247,960	23,346,614	1,009,557	27,113,056	1,115,526
Other		217,995		397,493		495,245		474,519		601,611
Total grass and clover seed		870,707		1,630,821		2,322,404		3,190,856		2,549,813
All other seeds		277,877		263,912		286,734		340,667		411,156
Total seeds		8,912,662		10,094,609		8,683,688		5,256,623		3,485,418
Spices		66,970		50,111		43,587		38,444		52,755
Spirits, distilled. (*See* Liquors, alcoholic.)										
Starch .... pounds..	66,574,881	1,490,797	51,334,580	1,126,465	48,125,851	1,142,054	33,228,278	780,155	51,535,570	1,274,773
Straw .... tons..	(a)	7,381	(a)	7,482	(a)	6,552	(a)	8,293	1,087	13,884

Sugar, molasses, and sirup:										
Molasses .... gallons..	10,205,885	977,097	3,193,322	297,493	3,320,419	425,757	3,973,908	440,225	1,505,355	216,336
Sirup .... do....	12,335,645	1,975,856	14,115,819	2,050,964	13,181,095	1,961,670	13,865,756	2,243,201	13,457,307	2,258,640
Sugar—										
Raw .... pounds..	276,556	7,797	58,587	1,812	13,285	523	60,882	1,742	54,447	2,051
Refined .... do....	21,899,290	823,221	21,179,016	829,350	25,497,358	973,661	79,885,415	2,783,334	125,452,575	5,396,009
Total sugar .... do....	22,175,846	831,018	21,237,603	831,162	25,510,643	974,184	79,946,297	2,785,076	125,507,022	5,398,060
Total sugar, molasses, and sirup	....	3,783,971	....	3,179,619	....	3,361,611	....	5,468,502	....	7,873,036
Teazels	....	5,012	....	550	....	2,056	....	(a)	....	(a)
Tobacco:										
Leaf .... pounds..	302,333,075	28,602,452	331,548,309	33,193,881	323,033,034	34,342,293	282,688,917	30,757,931	353,372,672	38,017,260
Stems and trimmings .... do....	9,894,127	205,915	9,194,555	183,517	7,779,624	384,864	5,212,029	144,969	3,823,402	98,126
Total .... do....	312,227,202	28,808,367	340,742,864	33,377,398	330,812,658	34,727,157	287,900,946	30,902,900	357,196,074	38,115,386
Vegetables:										
Fresh or dried—										
Beans and pease .... bushels..	447,474	960,710	435,490	932,264	506,939	708,201	298,209	702,819	365,721	973,231
Onions .... do....	205,102	182,060	257,747	217,582	174,820	184,166	366,989	318,051	254,255	208,134
Potatoes .... do....	1,000,326	743,993	1,530,461	1,278,034	1,203,894	1,077,612	763,651	715,701	999,476	759,277
Total fresh or dried .... do....	1,652,902	1,886,763	2,223,698	2,427,880	1,685,653	1,969,979	1,428,849	1,736,571	1,619,452	1,940,642
Prepared or preserved—										
Canned	....	658,739	....	598,628	....	621,987	....	728,111	....	782,973
Other	....	1,021,625	....	981,325	....	1,303,328	....	1,295,784	....	1,483,704
Total prepared or preserved..	....	1,680,364	....	1,579,953	....	1,925,315	....	2,023,895	....	2,266,677
Total vegetables	....	3,567,127	....	4,007,833	....	3,895,294	....	3,760,466	....	4,207,319
Vinegar .... gallons..	92,027	16,266	81,752	13,274	109,263	15,841	106,903	15,100	114,747	12,861
Wines. (*See* Liquors, alcoholic.)										
Yeast	....	23,099	....	38,465	....	37,658	....	50,455	....	71,245
Total vegetable matter, including forest products	....	784,218,428	....	892,555,792	....	869,206,323	....	776,634,500	....	797,831,221
Total vegetable matter, excluding forest products	....	707,242,997	....	799,607,087	....	778,844,250	....	704,192,046	....	712,800,991
Total agricultural exports, including forest products	....	1,053,022,535	....	1,147,354,121	....	1,107,758,477	....	975,680,576	....	956,188,655
Total agricultural exports, excluding forest products	....	976,047,104	....	1,054,405,416	....	1,017,396,404	....	903,238,122	....	871,158,425

a Not stated.

Foreign trade of the United States in agricultural products, 1851–1910.

[Compiled from reports of Foreign Commerce and Navigation of the United States. All values are gold.]

Year ending June 30—	Agricultural exports.[a]			Agricultural imports.[a]		Excess of exports (+) or of imports (−), agricultural.
	Domestic.		Foreign.	Total.	Percentage of all imports.	
	Total.	Percentage of all domestic exports.				
1851	$146,717,431	82.1	$5,084,886	$60,513,449	28.7	+891,288,868
1852	125,183,749	80.8	5,897,138	61,747,933	29.8	+ 69,332,954
1853	155,461,445	81.9	6,820,517	71,499,465	27.1	+ 90,782,497
1854	172.320,260	80.0	11,528,791	71,720,047	24.1	+112,129,004
1855	149,101,277	77.4	9,601,059	81,726,640	31.7	+ 76,975,696
1856	222,409,001	83.5	6,451,870	102,541,703	33.0	+126,319,168
1857	232,180,205	83.2	8,182,890	133,226,318	38.2	+107,136,777
1858	205,853,748	81.9	13,739,733	102,482,331	38.9	+117,111,150
1859	226,135,020	81.2	9,054,220	126,236,317	38.1	+108,952,923
1860	260,280,413	82.3	10,577,008	129,816,165	36.7	+141,041,256
1861	154,094,839	75.2	9,315,314	113,329,585	39.2	+ 50,080,568
1862	140,463,928	78.2	5,569,056	91,263,088	48.2	+ 54,769,896
1863	137,512,273	73.9	8,162,395	102,886,713	42.3	+ 42,787,955
1864	102,794,359	71.6	9,037,218	138,124,440	43.6	− 26,292,863
1865	84,886,860	62.0	17,876,028	114,031,753	47.8	− 11,268,865
1866	278,670,278	82.6	5,793,649	164,801,739	37.9	+119,662,188
1867	214,258,245	76.6	9,244,181	141,622,826	35.8	+ 81,879,600
1868	206,979,580	76.8	6,709,785	157,638,217	44.1	+ 56,051,148
1869	205,330,174	74.6	7,067,011	185,348,661	44.4	+ 27,048,524
1870	296,962,357	78.9	10,667,193	191,559,361	43.9	+116,070,189
1871	330,034,934	77.0	9,002,337	222,700,936	42.8	+116,336,335
1872	332,936,080	77.7	9,205,158	274,146,298	43.8	+ 67,994,940
1873	396,240,107	78.5	9,574,000	277,604,621	43.2	+128,209,486
1874	453,862,070	79.7	9,629,988	267,414,990	47.1	+196,077,068
1875	389,409,703	78.0	7,406.702	261,618,732	49.1	+135.197,673
1876	410,884,027	78.2	8,450,386	234,993,224	51.0	+184,341,189
1877	435,354,451	73.8	7,296,110	249,281,945	55.2	+193,368,616
1878	531,637,041	78.1	9,419,767	236,112,137	54.0	+304,944,671
1879	557,321,801	79.8	8,079,701	233,623,846	52.4	+331,777,656
1880	694,315,497	84.3	7,173,664	314,617,480	47.1	+386,871,681
1881	738,123,799	83.5	11,189,658	298,283,101	46.4	+451,030,356
1882	557,620,540	76.0	9,857,878	330,375.047	45.6	+237,103,371
1883	626,426,608	77.9	11,282,895	325,757,806	45.0	+311,951,697
1884	547,952,579	75.6	8,749,894	319,053,331	47.8	+237,649,142
1885	554,051,145	76.2	9,077,454	277,340,305	48.0	+285,788,294
1886	501,313,738	75.3	7,734,192	306,011,332	48.2	+203,036,598
1887	536,938,387	76.4	7,965,572	325,652,754	47.0	+219,251,205
1888	505,402,327	73.9	7,031,986	339,199.344	46.9	+173,234,969
1889	536,828,565	73.5	6,895,482	365,586,061	49.1	+178,137,986
1890	634,855,869	75.1	6,908,820	384,100,435	48.7	+257,664,254
1891	652.407,931	74.8	6,109,781	420,211,949	49.7	+238,305.763
1892	803,122,045	79.1	6,638,755	436,697,057	52.8	+373,063,743
1893	621,201,671	74.8	7,155,979	425,657,448	49.1	+202,700.202
1894	636,633,747	73.2	9,586,876	365,160,319	55.8	+281,060.304
1895	558,385,861	70.4	7,934,115	373,115,985	51.0	+193,203,991
1896	574,398,264	66.5	10,916,730	391.029,407	50.1	+194,285,587
1897	689,755,193	66.8	9,707,782	400,871,468	52.4	+298,591,507
1898	859,018,946	71.0	10,409,348	314,291,796	51.0	+555,136,498
1899	792,811,733	65.9	12,134,268	355.514,881	51.0	+449,431,120
1900	844,616,530	61.6	11,263,253	420,139,288	49.4	+435,740,495
1901	951,628,331	65.2	11,293,045	391,931,051	47.6	+570,990,325
1902	857,113,533	63.2	10,308,306	413,744,557	45.8	+453,677,282
1903	878,480,557	63.1	13,505,343	456,199,325	44.5	+435,786,575
1904	859,160,264	59.9	12,625,026	461,434,851	46.6	+410,350,439
1905	826,904,777	55.4	12,316.525	553,851,214	49.6	+285,370,088
1906	976,047,104	56.8	10,856,259	554,175,242	45.2	+432,728,121
1907	1,054,405,416	56.9	11,613,519	626,836.808	43.7	+439,182,127
1908	1,017,396,404	55.5	10,298.514	539,690,121	45.2	+488,004,797
1909	903,238,122	55.1	9,584,722	638,612,692	48.7	+274,210,152
1910	871,158,425	50.9	....	687,516,115	44.2	....
Average:						
1851–1855	149.756,832	80.4	7,786,478	69,441,507	28.1	+ 88,101.803
1856–1860	229,371,677	82.4	9,601,144	118,860,567	37.0	+120,112,254
1861–1865	123,950,452	72.8	9,992,002	111,927,116	43.8	+ 22,015,338
1866–1870	240,440,127	78.1	7,896,364	168,194,161	41.2	+ 80,142,330
1871–1875	380,496,579	78.3	8,963,637	260,697,115	45.1	+128,763,101
1876–1880	525,902,563	79.2	8,083,926	253,725,726	51.5	+280,260,763
1881–1885	604,834,934	78.1	10,031,556	310,161,918	46.5	+304,704,572
1886–1890	543,067,777	74.8	7,307,210	344,109,985	48.0	+206,265,002
1891–1895	654,350,251	74.7	7,485,101	404,168,552	51.5	+257,666,800
1896–1900	752,120,133	66.2	10,886,276	376,369,368	50.8	+386,637,041
1901–1905	874,657,492	61.4	12,009,649	455,432,200	46.8	+431,234,941
1906–1910	964,449,094	55.1	....	609,366,196	45.3	....

[a] Not including forest products.

Exports of selected domestic agricultural products, 1851–1910.

[Compiled from reports of Foreign Commerce and Navigation of the United States. Where figures are lacking, either there were no exports or they were not separately classified for publication. For "Beef salted or pickled," and "Pork, salted or pickled," barrels, 1851–1865, were reduced to pounds at the rate of 200 pounds per barrel, and tierces, 1855–1865, at the rate of 300 pounds per tierce; cotton-seed oil, 1910, pounds reduced to gallons at the rate of 7.5 pounds per gallon. It is assumed that 1 barrel of corn meal is the product of 4 bushels of corn, and 1 barrel of wheat flour the product of 5 bushels of wheat prior to 1880 and of 4½ bushels of wheat in 1880 and subsequently.]

Year ending June 30—	Cattle.	Cheese.	Packing-house products.				
			Beef, cured—salted or pickled.	Beef, fresh.	Beef oils—oleo oil.	Beef (mostly)—tallow.	Beef and its products—total, as far as ascertainable in pounds. *a*
	Number.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
1851	1,350	10,361,189	18,129,600			8,198,278	26,327,878
1852	1,078	6,650,420	24,451,800			4,767,020	29,218,820
1853	1,076	3,763,932	25,208,200			3,926,598	29,134,798
1854	1,022	7,003,974	25,244,000			9,325,471	34,569,471
1855	1,501	4,846,568	29,560,800			11,866,992	41,427,792
1856	2,478	8,737,029	25,437,800			7,458,471	32,896,271
1857	4,325	6,453,072	15,668,000			5,698,315	21,366,315
1858	28,247	8,098,527	23,961,400			8,283,812	32,245,212
1859	32,513	7,103,323	30,801,000			7,103,045	37,904,045
1860	27,501	15,515,799	38,858,800			15,269,535	54,128,335
1861	8,885	32,361,428	25,640,200			29,718,364	55,358,564
1862	3,634	34,052,678	27,204,400			46,773,768	73,978,168
1863	5,509	42,045,054	29,259,800			63,792,754	93,052,554
1864	6,191	47,751,329	35,666,400			55,197,914	90,864,314
1865	9,589	53,154,318	27,129,200			30,884,500	58,013,700
1866	7,730	36,411,985	19,053,800			19,364,686	38,418,486
1867	10,221	52,352,127	14,182,562			23,296,931	37,479,493
1868	16,120	51,097,203	22,683,531			22,682,412	45,365,943
1869		39,960,367	27,299,197			20,534,628	47,833,825
1870	27,530	57,296,327	26,727,773			37,513,056	64,240,829
1871	20,530	63,698,867	43,880,217			33,859,317	77,739,534
1872	28,033	66,204,025	26,652,094			76,151,218	102,803,312
1873	35,455	80,366,540	31,605,196			79,170,558	110,775,754
1874	56,067	90,611,077	36,036,537			101,755,631	137,792,168
1875	57,211	101,010,853	48,243,251			65,461,619	113,704,870
1876	51,593	97,676,264	36,596,150			72,432,775	109,028,925
1877	50,001	107,364,666	39,155,153	49,210,990		91,472,803	179,838,943
1878	80,040	123,783,736	38,831,379	54,046,771	1,698,401	85,505,919	180,082,470
1879	136,720	141,654,474	36,950,563	54,025,832	12,687,318	99,963,752	203,627,465
1880	182,756	127,553,907	45,237,472	84,717,194	19,844,256	110,767,627	260,566,549
1881	185,707	147,995,614	40,698,649	106,004,812	26,327,676	96,403,372	269,434,509
1882	108,110	127,989,782	45,899,737	69,586,466	19,714,338	50,474,210	187,832,197
1883	104,444	99,220,467	41,680,623	81,064,373	29,031,064	38,810,098	192,536,459
1884	190,518	112,869,575	42,379,911	120,784,064	37,785,159	63,091,103	266,219,082
1885	135,890	111,992,990	48,143,711	115,780,830	37,120,217	50,431,719	252,810,842
1886	119,065	91,877,235	58,903,370	99,423,362	27,729,885	40,919,951	228,729,576
1887	106,459	81,255,994	36,287,188	83,560,874	45,712,985	63,278,403	272,916,803
1888	140,208	88,008,458	48,980,269	93,498,273	30,146,595	92,483,052	307,379,042
1889	205,786	84,999,828	55,006,399	137,895,391	28,102,534	77,844,555	352,260,216
1890	394,836	95,376,053	97,508,419	173,237,596	68,218,098	112,745,370	536,986,026
1891	374,679	82,133,876	90,286,979	194,045,638	80,231,035	111,689,251	589,447,206
1892	394,607	82,100,221	70,204,736	220,554,617	91,581,703	89,780,010	561,713,699
1893	287,094	81,350,923	58,423,963	206,294,724	113,939,363	61,819,153	523,944,938
1894	359,278	73,852,134	62,682,667	193,891,824	123,295,895	54,661,524	495,624,104
1895	331,722	60,448,421	62,473,325	191,338,487	78,098,878	25,864,300	432,799,823
1896	372,461	36,777,291	70,709,209	224,783,225	103,276,756	52,759,212	521,804,584
1897	392,190	50,944,617	67,712,940	290,395,930	113,506,152	75,108,834	606,547,427
1898	439,255	53,167,280	44,314,479	274,768,074	132,579,277	81,744,809	576,433,797
1899	389,490	38,198,753	46,564,876	282,139,974	142,390,492	107,361,009	623,970,458
1900	397,286	48,419,353	47,306,513	329,078,609	146,739,681	89,030,943	674,284,723
1901	459,218	39,813,517	55,312,632	351,748,333	161,651,413	77,166,889	705,104,772
1902	392,884	27,203,184	48,632,727	301,824,473	138,546,088	34,065,758	596,254,520
1903	402,178	18,987,178	52,801,220	254,795,963	126,010,339	27,368,924	546,055,244
1904	593,409	23,335,172	57,584,710	299,579,671	165,183,839	76,924,174	663,147,095
1905	567,806	10,134,424	55,934,705	236,486,568	145,228,245	63,536,992	575,874,718

a Includes beef, canned; beef, cured—salted or pickled; beef, cured—other; beef, fresh; oils—oleo oil; oleomargarin; tallow.

Exports of selected domestic agricultural products, 1851–1910—Continued.

Year ending June 30—	Cattle.	Cheese.	Packing-house products. Beef, cured—salted or pickled.	Beef, fresh.	Beef oils—oleo oil.	Beef (mostly)—tallow.	Beef and its products—total, as far as ascertainable in pounds.
	Number.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
1906	584,239	16,562,451	81,088,098	268,054,227	209,658,075	97,567,156	732,884,572
1907	423,051	17,285,230	62,645,281	281,651,502	195,337,176	127,857,739	689,752,420
1908	349,210	8,439,031	46,958,367	201,154,105	212,541,157	91,397,507	579,303,478
1909	207,542	6,822,842	44,494,210	122,952,671	179,985,246	53,332,767	418,844,332
1910	139,430	2,846,709	36,554,266	75,729,666	126,091,675	29,379,992	286,295,874
Average:							
1851–1855	1,205	6,525,217	24,518,880	....	....	7,616,872	32,135,752
1856–1860	19,013	9,181,550	26,945,400	....	....	8,762,636	35,708,036
1861–1865	6,762	41,872,961	28,980,000	....	....	45,273,460	74,253,460
1866–1870	....	47,423,602	21,989,373	....	....	24,678,343	46,667,715
1871–1875	39,459	80,378,272	37,283,459	....	....	71,279,669	108,563,128
1876–1880	100,222	119,606,609	39,354,143	....	....	92,028,575	186,628,870
1881–1885	144,934	120,013,686	43,760,526	98,644,109	29,995,691	59,842,100	233,766,618
1886–1890	193,271	88,303,514	59,337,129	117,523,099	39,982,019	77,454,266	339,654,333
1891–1895	349,476	75,977,115	68,814,334	201,225,058	97,429,375	68,762,848	520,705,954
1896–1900	398,136	45,501,459	55,321,603	280,233,162	127,698,472	81,200,961	600,608,198
1901–1905	483,099	23,894,695	54,053,199	288,887,002	147,323,985	55,812,547	617,287,270
1906–1910	340,694	10,391,253	54,348,044	189,908,434	184,722,666	79,907,032	541,416,135

Year ending June 30—	Packing-house products—Continued. Pork, cured—bacon.	Pork, cured—hams.[a]	Pork, cured—salted or pickled.	Pork—lard.	Pork and its products—total, as far as ascertainable in pounds.[b]	Apples, fresh.	Corn and corn meal (converted to corn).
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Barrels.*	*Bushels.*
1851	18,027,302	....	33,041,200	19,683,082	70,751,584	28,842	4,241,299
1852	5,746,816	....	16,676,400	21,281,951	43,705,167	18,411	3,351,495
1853	18,390,027	....	25,976,200	24,435,014	68,801,241	45,075	3,123,381
1854	45,953,473	....	44,029,400	44,450,154	134,433,027	15,326	8,798,428
1855	38,188,989	....	59,752,000	39,025,492	136,966,481	33,959	8,876,417
1856	41,748,092	....	56,279,000	37,582,271	135,609,363	74,287	11,466,708
1857	43,863,539	....	28,902,600	40,246,544	113,012,683	33,201	8,575,334
1858	20,954,374	....	31,975,000	33,022,286	85,951,660	27,711	5,716,693
1859	11,989,694	....	41,148,400	28,362,706	81,500,800	32,979	2,755,538
1860	25,844,610	....	40,948,600	40,289,519	107,082,729	78,809	4,248,991
1861	50,264,267	....	31,297,400	47,908,911	129,470,578	112,523	11,491,496
1862	141,212,786	....	61,820,400	118,573,307	321,606,493	66,767	19,919,178
1863	218,243,609	....	65,570,400	155,336,596	439,150,605	174,502	17,151,268
1864	110,886,446	....	63,519,400	97,190,765	271,596,611	183,969	5,146,122
1865	46,053,034	....	41,786,800	44,480,136	132,319,970	120,317	3,616,653
1866	37,588,930	....	30,056,788	30,110,451	97,756,169	51,612	14,465,751
1867	25,648,226	....	27,374,877	45,608,031	98,631,134	29,577	16,026,947
1868	43,659,064	....	28,690,133	64,555,462	136,904,659	19,874	12,493,522
1869	49,228,165	....	24,439,832	41,887,545	115,555,542	....	8,286,665
1870	38,968,256	....	24,639,831	35,808,530	99,416,617	38,157	2,140,487
1871	71,446,854	....	39,250,750	80,037,297	190,734,901	49,088	10,673,553
1872	246,208,143	....	57,169,518	199,651,660	503,029,321	36,508	35,727,010
1873	395,381,737	....	64,147,461	230,534,207	690,063,405	241,663	40,154,374
1874	347,405,405	....	70,482,379	205,527,471	623,415,255	44,928	35,985,834
1875	250,286,549	....	56,152,331	166,869,393	473,308,273	276,209	30,025,036
1876	327,730,172	....	54,195,118	168,405,839	550,331,129	64,472	50,910,532
1877	460,057,146	....	69,671,894	234,741,233	764,470,273	417,065	72,652,611
1878	592,814,351	....	71,889,255	342,766,254	1,007,469,860	101,617	87,192,110
1879	732,249,576	....	84,401,676	326,658,686	1,143,309,938	505,018	87,884,892
1880	759,773,109	....	95,949,780	374,979,286	1,230,702,175	407,911	99,572,329
1881	673,274,361	73,670,184	107,928,086	378,142,496	1,233,015,127	1,117,065	93,648,147
1882	428,481,482	39,545,158	80,447,466	250,367,740	798,841,846	176,704	44,340,683
1883	294,118,759	46,139,911	62,116,302	224,718,474	627,093,446	313,921	41,655,653
1884	341,579,410	47,919,958	60,363,313	265,094,719	715,142,817	105,400	46,258,606
1885	345,924,217	54,202,902	71,649,365	283,216,339	755,416,926	668,867	52,876,456

[a] Subsequent to 1904, including shoulders.

[b] Includes lard; pork, canned; pork, cured—bacon; pork, cured—hams; pork, cured—salted or pickled; pork, fresh.

Exports of selected domestic agricultural products, 1851–1910—Continued.

Year ending June 30—	Packing-house products—Continued. Pork, cured—bacon.	Pork, cured—hams.	Pork, cured—salted or pickled.	Pork—lard.	Pork and its products—total, as far as ascertainable in pounds.	Apples, fresh.	Corn and corn meal (converted to corn).
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Barrels.*	*Bushels.*
1886	369,423,351	50,365,445	87,196,966	293,728,019	800,784,530	744,539	64.829,617
1887	364,417,744	55,505,211	85,869,367	321,533,746	827,349,998	591,868	41,368,584
1888	331,306,703	44,132,980	58,836,966	297,740,007	732,079,843	489,570	25,360,869
1889	357,377,399	42,847,247	64,110,845	318,242,990	782,601,275	942,406	70,841,673
1890	531,899,677	76,591,279	79,788,868	471,083,598	1,159,642,885	453,506	103,418,709
1891	514,675,557	84,410,108	81,317,364	498,343,927	1,179,565,831	135,207	32,041,529
1892	507,919,830	76,856,559	80,336,481	460,045,776	1,125,536,392	938,743	76,602,285
1893	391,758,175	82,178,154	52,459,722	365,693,501	893,002,196	408,014	47,121,894
1894	416,657,577	86,970,571	63,575,881	447,566,867	1,015,939,543	78,580	66,489,529
1895	452,549,976	105,494,123	58,266,893	474,895,274	1,092,024,847	818,711	28,585,405
1896	425,352,187	129,036,351	69,498,373	509,534,256	1,134,165,823	360,002	101,100.375
1897	500,399,448	165,247,302	66,768,920	568,315,640	1,302,037,734	1,503,981	178,817,417
1898	650,108,933	200,185,861	88,133,078	709,344,045	1,659,996,202	605,390	212,055,543
1899	562,651,480	225,846,750	137,197,200	711,259,851	1,678,265,645	380,222	177,255,046
1900	512,153,729	196,414,412	133,199,683	661,813,663	1,538,024,466	526,636	213,123,412
1901	456,122,741	216,571,803	138,643,611	611,357,514	1,462,369,849	883,673	181,405,473
1902	383,150,624	227,653,232	115,896,275	556,840,222	1,337,315,909	459,719	28,028,688
1903	207,336,000	214,183,365	95,287,374	490,755,821	1,042,119,570	1,656,129	76,639,261
1904	249,665,941	194,948,864	112,224,861	561,302,643	1,146,255,441	2,018,262	58,222,061
1905	262,246,635	203,458,724	118,887,189	610,238,899	1,220,031,970	1,499,942	90,293,483
1906	361,210,563	194,267,949	141,820,720	741,516,886	1,464,960,356	1,208,989	119,893,833
1907	250,418,699	209,481,496	166,427,409	627,559,660	1,268,065,412	1,539,267	86,368,228
1908	241,189,929	221,769,634	149,505,937	603,413,770	1,237,210,760	1,049,545	55,063,860
1909	244,578,674	212,170,224	52,354,980	528,722,933	1,053,142,056	896,279	37,665,040
1910	152,163,107	146,885,385	40,031,599	362,927,671	707,110,062	922,078	38.128,498
Average:							
1851-1855	25,261,321	....	35,895,040	29,775,139	90,931,500	28.323	5,678,204
1856-1860	28,880,062	....	39,850,720	35,900,665	104,631,447	49,397	6,552,653
1861-1865	113,332,028	....	52,798,880	92,697,943	258,828,851	131,616	11,464,943
1866-1870	39,018,528	....	27,040,292	43,594,004	109,652,824	....	10,682,674
1871-1875	262,145,738	....	57,440,488	176,524,006	496,110,231	129,679	30,513,161
1876-1880	574,524,871	....	75,221,545	289,510,260	939,256 675	299 217	79,642,495
1881-1885	416,675,646	52,295,623	76,500,906	280,307,954	825,902,032	476,391	55,755,909
1886-1890	390,884,975	53,888,432	75,160,602	340,465,672	860,491,706	644,378	61,163,890
1891-1895	456,712,223	87,181,903	67,191,268	449,309,069	1,061,213,762	475,851	50,168,128
1896-1900	530,133,155	183,346,135	98,959,451	632,053,491	1,462,497,974	675,246	176,470,359
1901-1905	311,704,388	211,363,198	116,187,862	566,099,020	1,241,618,548	1,303,545	86,917,793
1906-1910	249,912,194	196,914,938	110,028,129	572,828,184	1,146,097,729	1,123,232	67,423,892

Year ending June 30—	Hops.	Oils, vegetable—cottonseed oil.	Rice and rice bran, meal and polish.	Sugar, raw and refined.	Wheat.	Wheat flour.	Wheat and wheat flour (converted to wheat).
	Pounds.	*Gallons.*	*Pounds.*	*Pounds.*	*Bushels.*	*Barrels.*	*Bushels.*
1851	110,360	....	63,354,000	3,251,369	1,026,725	2,202,335	12,038,400
1852	238,008	....	71,839,800	2,498,390	2,694,540	2,799,339	16,691,235
1853	245,647	....	40,624,200	5,827,331	3,890,141	2,920,918	18,494,731
1854	260,026	....	63,072,600	9,893,751	8,036,665	4,022,386	28,148,595
1855	4,021,816	....	39,421,600	11,160,945	798,884	1,204,540	6,821,584
1856	1,048,515	....	67,616,000	9,271,191	8,154,877	3,510,626	25,708,007
1857	924,538	....	68,322,800	5,338,247	14,570,331	3,712,053	33,130,596
1858	458,889	....	58,122,200	7,201,120	8,926,196	3,512,169	26,487,041
1859	587.953	....	77,070,400	6,558,757	3,002,016	2,431,824	15,161,136
1860	273,257	....	81,632,600	4,466,031	4,155,153	2,611,596	17,213,133
1861	8,835,837	....	43,512,400	6,511,134	31,238,057	4,323,756	52,856,837
1862	4,860,046	....	4,221,600	2,755,252	37,289,572	4,882,033	61,699,737
1863	8,864,081	....	1,694,800	3,595,009	36,160,414	4,390,055	58,110,689
1864	5,851,165	....	2,176,800	2,328,483	23,681,712	3,557,347	41,468,447
1865	3,671,371	....	983,200	1,900,002	9,937,876	2,641,298	23,144,366

Exports of selected domestic agricultural products, 1851-1910—Continued.

Year ending June 30—	Hops.	Oils, vegetable—cottonseed oil.	Rice and rice bran, meal and polish.	Sugar, raw and refined.	Wheat.	Wheat flour.	Wheat and wheat flour (converted to wheat).
	Pounds.	*Gallons.*	*Pounds.*	*Pounds.*	*Bushels.*	*Barrels.*	*Bushels.*
1866	349,987	....	2,212,901	4,460,138	5,579,103	2,183,050	16,494,353
1867	1,001,603	....	1,394,007	8,130,175	6,146,411	1,300,106	12,646,941
1868	532,038	....	3,079,043	2,218,150	15,940,899	2,076,423	26,323,014
1869	11,269,555	....	2,232,833	3,167,523	17,557,836	2,431,873	29,717,201
1870	16,356,231	....	2,133,014	4,427,576	36,584,115	3,463,333	53,900,780
1871	3,273,653	....	445,842	3,841,078	34,304,906	3,653,841	52,574,111
1872	3,061,244	547,165	403,835	4,478,492	26,423,080	2,514,535	38,995,755
1873	1,795,437	709,576	276,637	10,083,363	39,204,285	2,562,086	52,014,715
1874	117,358	782,067	558,922	10,132,911	71,039,928	4,094,094	91,510,398
1875	3,066,703	417,387	277,337	24,152,388	53,047,177	3,973,128	72,912,817
1876	9,191,589	281,054	439,991	51,863,691	55,073,122	3,935,512	74,750,682
1877	9,581,108	1,705,422	1,306,982	39,751,324	40,325,611	3,343,665	57,043,936
1878	18,458,782	4,992,349	631,105	44,093,092	72,404,961	3,947,333	92,141,626
1879	5,458,159	5,352,530	740,136	72,352,964	122,353,936	5,629,714	150,502,506
1880	9,739,566	6,997,796	183,534	30,142,004	153,252,795	6,011,419	180,304,181
1881	8,990,655	3,444,084	150,451	22,252,833	150,565,477	7,945,786	186,321,514
1882	5,867,363	713,549	143,289	13,814,005	95,271,802	5,915,686	121,892,389
1883	7,817,228	415,611	136,143	28,542,115	106,385,828	9,205,664	147,811,316
1884	13,516,643	3,605,946	163,519	76,122,813	70,349,012	9,152,260	111,534,182
1885	7,055,289	6,364,279	663,502	252,740,427	84,653,714	10,648,145	132,570,366
1886	13,665,661	6,240,139	1,700,576	164,429,490	57,759,209	8,179,241	94,565,793
1887	260,721	4,067,138	4,126,630	190,804,677	101,971,949	11,518,449	153,804,969
1888	6,793,818	4,458,597	1,858,735	34,646,157	65,789,261	11,963,574	119,625,344
1889	12,589,262	2,690,700	2,890,027	14,259,414	46,414,129	9,374,803	88,600,743
1890	7,540,854	13,384,385	3,681,979	27,225,469	54,387,767	12,231,711	109,430,467
1891	8,736,080	11,003,160	3,490,895	108,433,474	55,131,948	11,344,304	106,181,316
1892	12,604,686	13,859,278	10,256,796	14,850,391	157,280,351	15,196,769	225,665,811
1893	11,367,030	9,462,074	13,711,798	20,746,327	117,121,109	16,620,339	191,912,635
1894	17,472,975	14,958,309	10,766,249	15,468,496	88,415,230	16,859,533	164,283,129
1895	17,523,388	21,187,728	1,623,336	9,529,008	76,102,704	15,268,892	144,812,718
1896	16,765,254	19,445,848	15,031,554	9,402,524	60,650,080	14,620,864	126,443,968
1897	11,426,241	27,198,882	3,905,754	8,305,219	79,562,020	14,569,545	145,124,972
1898	17,161,669	40,230,784	6,200,987	6,508,290	148,231,261	15,349,943	217,306,005
1899	21,145,512	50,627,219	15,334,689	9,865,347	139,432,815	18,485,690	222,618,420
1900	12,639,474	46,902,390	41,066,417	22,514,603	101,950,389	18,699,194	186,096,762
1901	14,963,676	49,356,741	25,527,846	8,874,860	132,060,667	18,650,979	215,990,073
1902	10,715,151	33,042,848	29,591,274	7,572,452	154,856,102	17,759,203	234,772,516
1903	7,794,705	35,642,994	19,750,448	10,520,156	114,181,420	19,716,484	202,905,598
1904	10,985,988	29,013,743	29,121,763	15,418,537	44,230,169	16,999,432	120,727,613
1905	14,858,612	51,535,580	113,282,760	18,348,077	4,394,402	8,826,335	44,112,910
1906	13,026,904	43,793,519	38,142,103	22,175,846	34,973,291	13,919,048	97,609,007
1907	16,809,534	41,880,304	30,174,371	21,237,603	76,569,423	15,584,667	146,700,425
1908	22,920,480	41,019,991	28,444,415	25,510,643	100,371,057	13,927,247	163,043,669
1909	10,446,884	51,087,329	20,511,429	79,946,297	66,923,244	10,521,161	114,268,468
1910	10,589,254	29,860,667	26,779,188	125,507,022	46,679,876	9,040,987	87,364,318
Average:							
1851-1855	975,171	....	55,662,440	6,526,357	3,289,391	2,629,904	16,438,909
1856-1860	658,630	....	70,552,800	6,567,069	7,761,715	3,155,654	23,539,985
1861-1865	6,416,500	....	10,517,760	3,417,976	27,661,526	3,958,898	47,456,016
1866-1870	5,901,883	....	2,210,360	4,480,712	16,361,673	2,290,957	27,816,458
1871-1875	2,262,879	....	392,515	10,537,646	44,803,875	3,359,537	61,601,560
1876-1880	10,485,841	3,865,830	660,350	47,640,615	88,682,085	4,573,529	110,948,586
1881-1885	8,649,436	2,908,694	251,381	78,694,439	101,445,167	8,573,508	140,025,953
1886-1890	8,170,063	6,168,192	2,851,589	86,273,041	65,264,463	10,653,556	113,205,463
1891-1895	13,540,832	14,094,110	7,969,815	33,805,539	98,810,268	15,057,967	166,571,122
1896-1900	15,827,630	36,881,025	16,307,880	11,319,197	105,965,313	16,345,047	179,518,025
1901-1905	11,863,626	39,718,381	43,454,818	12,146,816	89,944,552	16,390,487	163,701,742
1906-1910	14,758,611	41,528,362	28,810,301	54,875,482	65,103,378	12,598,622	121,797,177

Imports of selected agricultural products, 1851–1910.

[Compiled from reports of Foreign Commerce and Navigation of the United States. Where figures are lacking, either there were no imports or they were not separately classified for publication. "Silk" includes, prior to 1881, only "Silk, raw or as reeled from the cocoon;" in 1881 and 1882 are included this item and "Silk waste;" after 1882, both these items and "Silk cocoons." From "Cocoa and chocolate" are omitted in 1860, 1861, and in 1872 to 1881, small quantities of chocolate, the official returns for which were given only in value. "Jute and jute butts" includes in 1858 and 1859 an unknown quantity of "Sisal grass, coir, etc.," and in 1865–1868 an unknown quantity of "Hemp." Cattle hides are included in "Hides and skins other than cattle and goat" in [illegible]. Olive oil for table use includes in 1862–1864 and 1885–1905 all olive oil. Sisal grass includes in [illegible] "Other vegetable susbtances." Hemp includes in 1885–1888 all substitutes for hemp.]

Year ending June 30—	Cheese.	Silk.	Wool.	Almonds.	Argols or wine lees.	Cocoa and chocolate, total.	Coffee.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
1851	603,398		32,607,315	2,854,804		2,198,609	152,519,743
1852	514,337		18,343,218	1,564,703		1,372,341	193,906,353
1853	874,949		21,616,035	4,721,250		3,453,268	199,408,045
1854	969,417		20,282,635	2,187,934		3,162,072	162,255,993
1855	1,526,942		18,814,402	3,716,251		2,427,707	191,478,657
1856	1,384,272		16,280,947	5,113,897		2,017,471	235,865,268
1857	1,400,252		17,750,156	2,845,594		2,044,637	240,676,227
1858	1,589,066			2,210,941		1,810,449	189,211,300
1859	1,409,420			5,439,210		5,067,369	264,436,534
1860	1,401,161			2,873,014		3,186,721	202,144,733
1861	1,090,835			2,886,698	976,072	3,210,291	184,706,655
1862	594,822			918,360	866,404	3,541,364	122,799,311
1863	545,966			1,726,281	1,007,585	2,055,198	80,461,614
1864	836,127	407,935		3,964,875	1,597,790	2,940,571	131,622,782
1865	985,362			1,229,112	1,297,962	1,177,594	106,463,062
1866		567,904		4,571,687	2,004,996	2,550,978	181,413,192
1867	1,738,657	491,983		4,315,819	1,876,731	3,387,890	187,236,580
1868	2,997,944	512,449		1,461,007	1,822,498	3,211,976	248,983,900
1869		720,045	39,275,926		2,346,978	3,826,905	254,160,993
1870		583,589			2,591,472	3,640,845	235,256,574
1871		1,100,281			3,164,965	3,445,453	317,992,048
1872		1,063,809			4,942,601	4,917,809	298,805,946
1873		1,159,420	85,496,049		4,007,779	5,734,356	293,297,271
1874		794,837	42,939,541		3,246,376	3,661,992	285,171,512
1875		1,101,681	54,901,760		5,512,808	5,257,255	317,970,665
1876		1,354,991	44,642,836		7,047,802	4,715,406	339,789,246
1877		1,186,170	42,171,192		9,025,542	4,694,215	331,639,723
1878		1,182,750	48,449,079		10,257,909	4,780,339	309,882,540
1879		1,889,776	39,005,155		14,011,764	5,827,027	377,848,473
1880		2,562,236	128,131,747		14,445,534	7,508,130	446,850,727
1881		2,790,413	55,964,236		14,275,530	8,767,728	455,189,534
1882		3,221,269	67,861,744		18,320,366	11,091,123	459,922,768
1883		4,731,106	70,575,478		16,112,427	9,437,791	515,878,515
1884	6,243,014	4,284,888	78,350,651	3,828,104	19,591,039	12,739,871	534,785,542
1885	6,247,560	4,308,908	70,596,170	4,732,269	17,694,336	10,868,497	572,599,552
1886	6,309,124	6,818,060	129,084,958	5,822,733	16,041,666	13,703,583	564,707,533
1887	6,592,192	6,028,091	114,038,030	5,482,363	22,024,768	13,005,327	526,109,170
1888	8,750,185	6,370,322	113,558,753	5,747,957	17,226,491	17,502,929	423,645,794
1889	8,207,026	6,645,124	126,487,729	5,545,400	21,429,434	17,929,076	578,397,454
1890	9,263,573	7,510,440	105,431,285	5,715,858	24,908,054	19,894,130	499,159,120
1891	8,863,640	6,266,629	129,303,648	6,812,061	21,579,102	23,278,785	519,528,432
1892	8,305,288	8,834,049	148,670,652	7,629,392	24,813,171	23,712,261	640,210,788
1893	10,195,924	8,497,477	172,433,838	6,679,147	28,770,810	26,459,880	563,469,068
1894	8,742,851	5,902,485	55,152,585	7,436,784	22,373,180	19,899,393	550,934,337
1895	10,276,293	9,316,460	206,033,906	7,903,375	27,911,122	31,638,261	652,208,975
1896	10,728,397	9,363,987	230,911,473	7,789,681	28,481,665	25,666,373	580,597,915
1897	12,319,122	7,993,444	350,852,026	9,644,338	23,457,576	34,370,048	737,645,670
1898	10,012,188	12,087,951	132,795,202	5,746,362	19,202,629	27,525,513	870,514,455
1899	11,826,175	11,250,383	76,736,209	9,957,427	23,300,762	37,563,098	831,827,063
1900	13,455,990	13,073,718	155,928,455	6,317,633	27,339,489	43,968,252	787,991,911
1901	15,329,099	10,405,555	103,583,505	5,140,232	28,598,781	47,620,204	854,871,310
1902	17,067,714	14,234,826	166,576,966	9,868,982	29,276,148	52,878,587	1,091,004,252
1903	20,671,384	15,270,859	177,137,796	8,142,164	29,966,557	65,046,884	915,086,380
1904	22,707,103	16,722,709	173,742,834	9,838,852	24,571,730	75,070,746	995,043,284
1905	23,095,705	22,357,307	249,135,746	11,745,081	26,281,931	77,383,024	1,047,792,984

Imports of selected agricultural products, 1851–1910—Continued.

Year ending June 30—	Cheese.	Silk.	Wool.	Almonds.	Argols or wine lees.	Cocoa and chocolate, total.	Coffee.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
1906	27,286,866	17,352,021	201,688,668	15,009,326	28,140,835	84,127,027	851,668,933
1907	33,848,766	18,743,904	203,847,545	14,233,613	30,540,893	97,059,513	985,321,473
1908	32,530,830	16,662,132	125,980,524	17,144,968	26,738,834	86,604,684	890,640,057
1909	35,548,143	25,187,957	266,409,304	11,029,421	32,115,646	132,660,931	1,049,868,768
1910	40,817,524	23,457,223	263,928,232	18,556,356	28,182,956	111,070,834	871,469,516
Average:							
1851–1855	897,809	....	22,332,721	3,008,988	....	2,522,799	179,913,758
1856–1860	1,436,834	....	....	3,696,531	....	2,825,329	226,466,812
1861–1865	810,622	....	....	2,145,065	1,149,163	2,585,004	125,210,685
1866–1870	....	575,194	....	....	2,128,535	3,323,719	221,410,248
1871–1875	....	1,044,006	....	....	4,174,906	4,603,373	302,647,488
1876–1880	....	1,635,185	60,480,002	....	10,957,710	5,505,023	361,202,142
1881–1885	....	3,867,317	68,669,656	....	17,198,740	10,581,002	507,675,182
1886–1890	7,824,420	6,674,407	117,720,151	5,662,862	20,326,083	16,407,009	518,403,814
1891–1895	9,276,799	7,763,420	142,318,926	7,292,152	25,089,477	24,997,716	585,270,320
1896–1900	11,668,374	10,753,897	189,444,673	7,891,088	24,356,424	33,818,657	761,715,403
1901–1905	19,774,201	15,798,251	174,035,369	8,947,062	27,739,029	63,599,889	980,759,642
1906–1910	34,006,426	20,280,647	212,370,855	15,194,737	29,143,833	102,304,598	929,793,749

Year ending June 30—	Flax.	Hemp.	Hops.	Jute and jute butts.	Licorice root.	Manila.	Molasses.
	Tons.	*Tons.*	*Pounds.*	*Tons.*	*Pounds.*	*Tons.*	*Gallons.*
1851	1,059	1,876	....	1,919	....	9,917	36,376,772
1852	1,411	1,341	....	2,012	....	8,469	32,795,610
1853	678	2,621	....	1,269	....	12,510	31,886,100
1854	1,160	2,632	....	4,368	....	10,510	27,759,463
1855	1,454	961	....	4,665	607,596	14,254	26,385,593
1856	1,011	317	....	3,908	401,277	14,678	23,617,674
1857	1,149	3,082	....	5,589	1,099,073	17,668	32,705,844
1858	....	2,314	....	21,586	668,786	....	24,566,357
1859	....	3,378	....	22,538	993,161	....	32,818,146
1860	....	2,274	....	23,279	2,561,964	....	30,922,633
1861	....	2,211	....	13,203	1,539,882	6,366	29,941,397
1862	693	2,218	....	2,004	460,632	10,329	25,157,280
1863	1,594	732	....	2,592	1,173,034	13,961	30,854,264
1864	1,650	1,195	....	2,498	4,715,628	16,735	33,571,230
1865	....	1,627	3,837	2,990	793,197	13,948	36,445,906
1866	....	....	1,696,681	5,980	2,296,970	22,856	45,285,983
1867	1,571	3,193	865,016	7,809	3,034,255	15,273	56,123,079
1868	....	....	3,585,843	3,690	2,183,376	17,390	56,408,435
1869	1,953	18,731	....	17,549	....	....	53,304,030
1870	1,927	22,557	....	19,049	....	....	56,373,537
1871	3,672	20,805	....	26,450	....	....	44,401,359
1872	5,274	27,613	....	41,851	....	....	45,214,403
1873	4,171	20,573	....	63,329	....	....	43,533,909
1874	3,426	24,325	....	36,991	....	....	47,189,837
1875	4,322	23,063	....	43,402	....	....	49,112,255
1876	3,659	17,979	....	60,368	....	....	39,026,200
1877	4,498	17,128	....	50,793	....	....	30,327,825
1878	4,045	20,503	....	40,997	....	....	27,577,542
1879	2,935	17,711	....	69,590	....	....	38,460,347
1880	4,378	24,902	....	82,471	....	....	38,120,880
1881	5,446	32,044	497,243	68,631	....	....	28,708,221
1882	5,563	36,679	955,854	84,186	....	....	37,268,830
1883	5,748	29,063	2,122,589	125,318	....	....	33,228,276
1884	5,086	25,925	701,104	64,389	39,056,653	....	34,128,640
1885	6,435	32,463	1,642,086	98,343	26,406,008	....	31,392,893
1886	5,557	28,655	2,672,762	83,054	58,531,952	....	39,079,808
1887	7,140	32,739	18,538,049	88,514	79,603,835	....	38,007,700
1888	5,691	47,947	5,585,033	115,163	49,167,173	....	35,582,539
1889	7,896	55,835	4,176,158	88,655	57,068,600	....	27,024,551
1890	8,048	36,591	6,539,516	90,399	55,220,348	....	31,497,243

Imports of selected agricultural products, 1851–1910—Continued.

Year ending June 30—	Flax.	Hemp.	Hops.	Jute and jute butts.	Licorice root.	Manila.	Molasses.
	Tons.	*Tons.*	*Pounds.*	*Tons.*	*Pounds.*	*Tons.*	*Gallons.*
1891	6,331	11,484	4,019,603	141,704	55,307,911	35,331	20,604,463
1892	7,812	5,187	2,506,224	88,624	98,659,583	44,574	22,448,209
1893	6,696	4,817	2,691,244	82,231	93,002,250	59,439	15,490,679
1894	4,352	1,635	828,022	50,037	70,158,301	35,233	19,670,663
1895	7,233	6,954	3,133,664	110,671	83,281,275	50,278	15,075,879
1896	7,833	8,450	2,772,045	88,992	87,123,461	47,244	4,687,664
1897	9,190	5,120	3,017,821	68,550	62,370,337	46,260	3,702,471
1898	5,529	4,017	2,375,922	112,306	70,136,591	50,270	3,603,547
1899	6,474	3,941	1,319,319	83,161	98,432,319	53,195	5,821,556
1900	6,967	3,400	2,589,725	102,693	106,333,199	42,624	7,025,068
1901	6,878	4,057	2,606,708	103,140	100,105,654	43,735	11,453,156
1902	7,772	6,054	2,805,293	128,963	109,077,323	56,453	14,391,215
1903	8,155	4,919	6,012,510	79,703	88,580,611	61,648	17,240,399
1904	10,123	5,871	2,758,163	96,735	89,463,182	65,666	18,828,530
1905	8,089	3,987	4,339,379	98,215	108,443,892	61,562	19,477,885
1906	8,729	5,317	10,113,989	103,945	102,151,969	58,738	16,021,076
1907	8,656	8,718	6,211,893	104,489	66,115,863	54,513	24,630,935
1908	9,528	6,213	8,493,265	107,533	109,355,720	52,467	18,882,756
1909	9,870	5,208	7,386,574	156,685	97,742,776	61,902	22,092,696
1910	12,761	6,423	3,200,560	68,155	82,207,496	93,253	31,292,165
Average:							
1851–1855	1,151	1,886	...	2,847	...	11,132	31,040,708
1856–1860	...	2,273	...	15,380	1,144,852	...	28,926,131
1861–1865	...	1,597	...	4,657	1,736,475	12,268	31,194,015
1866–1870	...	...	...	10,815	...	...	53,499,013
1871–1875	4,173	23,276	...	42,405	...	...	45,890,353
1876–1880	3,903	19,645	...	60,844	...	...	34,702,559
1881–1885	5,656	31,235	1,183,775	88,173	...	...	32,945,372
1886–1890	6,866	40,353	7,502,304	93,157	59,920,182	...	34,238,368
1891–1895	6,485	6,015	2,635,751	94,653	80,081,864	44,971	18,657,979
1896–1900	7,199	4,986	2,414,966	91,140	84,879,181	47,919	4,968,061
1901–1905	8,203	4,978	3,704,411	101,351	99,134,132	57,813	16,278,237
1906–1910	9,909	6,376	7,081,256	108,161	91,514,765	64,175	22,583,926

Year ending June 30—	Olive oil, for table use.	Opium, crude.	Potatoes.	Rice, and rice flour, rice meal, and broken rice.	Sisal grass.	Sugar, raw and refined.	Tea.
	Gallons.	*Pounds.*	*Bushels.*	*Pounds.*	*Tons.*	*Pounds.*	*Pounds.*
1851	...	40,885	299,132	...	...	380,402,289	17,461,114
1852	...	42,123	322,223	...	...	457,511,093	29,437,206
1853	...	131,370	353,082	...	...	464,392,280	22,721,745
1854	...	108,178	306,187	...	...	455,928,585	24,417,712
1855	...	111,229	516,241	...	...	473,809,847	25,333,097
1856	...	157,814	535,320	...	...	545,226,430	22,889,850
1857	...	131,154	693,611	...	...	776,984,262	20,367,824
1858	...	135,915	...	...	...	519,200,387	32,995,021
1859	...	71,839	...	...	...	655,846,362	29,268,757
1860	...	119,525	...	...	...	694,838,197	31,696,657
1861	...	109,536	753,511	...	...	809,749,958	26,419,956
1862	292,024	194,844	837,223	56,861,317	287	557,139,529	24,795,983
1863	173,561	62,618	327,315	61,196,740	567	522,122,085	29,761,037
1864	79,457	93,114	4,497	99,691,447	1,021	632,230,247	37,229,176
1865	87,860	110,790	10,955	60,407,756	332	651,638,818	19,568,318
1866	256,833	181,585	78,194	76,209,397	870	1,000,055,024	42,992,738
1867	124,497	135,305	198,265	44,782,223	864	849,054,006	39,892,658
1868	161,313	183,263	209,555	59,140,707	1,661	1,121,189,415	37,843,612
1869	176,687	157,182	138,470	53,065,191	...	1,247,833,430	43,754,354
1870	159,397	254,609	75,336	43,123,939	...	1,196,773,569	47,408,481
1871	142,243	315,121	458,758	64,655,827	...	1,277,473,653	51,364,919
1872	196,364	416,864	96,259	74,642,631	...	1,509,185,674	63,811,003
1873	182,818	319,134	346,840	83,755,225	...	1,568,304,592	64,815,136
1874	139,241	395,909	549,073	73,257,716	...	1,701,297,869	55,811,605
1875	176,119	305,136	188,757	59,414,749	...	1,797,509,990	64,856,899

Imports of selected agricultural products, 1851–1910—Continued.

Year ending June 30—	Olive oil, for table use.	Opium, crude.	Potatoes.	Rice, and rice flour, rice meal, and broken rice.	Sisal grass.	Sugar, raw and refined.	Tea.
	Gallons.	*Pounds.*	*Bushels.*	*Pounds.*	*Tons.*	*Pounds.*	*Pounds.*
1876........	178,232	388,311	92,148	71,561,852	....	1,493,977,472	62,887,153
1877........	194,069	349,223	3,205,555	64,013,064	....	1,654,556,831	58,347,112
1878........	217,017	430,950	528,584	47,489,878	....	1,537,451,934	65,366,704
1879........	192,326	405,957	2,624,149	75,824,923	....	1,834,365,836	60,194,673
1880........	264,762	533,451	721,868	57,006,255	....	1,829,301,684	72,162,936
1881........	224,362	318,700	2,170,372	68,739,409	....	1,946,865,165	81,843,988
1882........	264,838	370,249	8,789,860	79,412,841	....	1,990,449,609	78,769,060
1883........	257,375	457,499	2,362,362	96,673,080	....	2,137,819,123	73,479,164
1884........	....	326,539	425,408	106,630,523	32,082	2,756,416,896	67,665,910
1885........	493,928	334,169	658,633	119,074,577	36,897	2,717,884,653	72,104,956
1886........	634,354	471,276	1,937,416	97,562,353	35,300	2,689,881,765	81,887,998
1887........	744,766	568,263	1,432,490	103,950,359	36,355	3,136,443,240	89,831,221
1888........	654,162	477,020	8,259,538	155,623,501	36,401	2,700,284,282	84,627,870
1889........	893,338	391,563	883,380	186,376,560	38,542	2,762,202,967	79,575,984
1890........	893,984	473,095	3,415,578	124,029,171	50,858	2,934,011,560	83,886,829
1891........	605,509	466,554	5,401,912	214,363,582	39,213	3,483,477,222	83,453,339
1892........	706,486	587,118	186,871	148,103,688	48,020	3,556,509,165	90,079,039
1893........	686,852	615,957	4,317,021	147,483,828	54,431	3,766,445,347	89,061,287
1894........	757,478	716,881	3,002,578	142,161,817	48,468	4,345,193,881	93,518,717
1895........	775,046	358,455	1,341,533	219,564,320	47,596	3,574,510,454	97,253,458
1896........	942,598	365,514	175,240	146,724,607	52,130	3,896,338,557	93,998,372
1897........	928,567	1,072,914	246,178	197,816,134	63,266	4,918,905,733	113,347,175
1898........	736,877	123,845	1,171,378	190,285,315	69,322	2,689,920,851	71,957,715
1899........	930,042	513,499	530,420	204,177,293	71,898	3,980,250,769	74,089,899
1900........	967,702	544,938	155,861	116,679,891	76,921	4,018,086,530	84,845,107
1901........	983,059	583,208	371,911	117,199,710	70,076	3,975,005,840	89,806,453
1902........	1,339,097	534,189	7,656,162	157,658,894	89,583	3,031,915,875	75,579,125
1903........	1,494,132	516,570	358,505	169,656,284	87,025	4,216,108,106	108,574,905
1904........	1,713,590	573,055	3,166,581	154,221,772	109,214	3,700,623,613	112,905,541
1905........	1,923,174	594,680	181,199	106,483,515	100,301	3,680,932,998	102,706,599
1906........	2,447,131	469,387	1,948,160	166,547,957	98,037	3,979,331,430	93,621,750
1907........	3,449,517	565,252	176,917	209,603,180	99,061	4,391,839,975	86,368,490
1908........	3,799,112	285,845	403,952	212,783,392	103,994	3,371,997,112	94,149,564
1909........	4,129,454	517,388	8,383,966	222,900,422	91,451	4,189,421,018	114,916,520
1910........	3,702,210	449,239	353,208	225,400,545	99,966	4,094,545,936	85,626,370
Average:							
1851–1855.	....	86,757	359,373	....	....	446,408,820	23,874,175
1856–1860.	....	123,249	....	....	....	638,419,128	27,443,622
1861–1865.	....	114,180	386,700	....	....	634,576,127	27,554,894
1866–1870.	175,745	182,389	139,964	55,264,291	....	1,082,981,089	42,378,369
1871–1875.	167,357	350,433	327,937	71,145,230	....	1,570,754,356	60,131,912
1876–1880.	209,281	421,578	1,434,461	63,179,194	....	1,669,930,751	63,791,716
1881–1885.	....	361,431	2,881,327	94,106,086	....	2,309,887,089	74,772,616
1886–1890.	764,121	476,243	3,185,680	133,508,389	39,491	2,844,564,763	83,961,980
1891–1895.	706,274	548,993	2,849,983	174,335,447	47,546	3,745,227,214	90,673,168
1896–1900.	901,157	524,142	455,815	171,136,648	66,707	3,900,700,488	87,647,654
1901–1905.	1,490,610	560,340	2,346,872	141,044,035	91,240	3,720,917,286	97,914,525
1906–1910.	3,505,485	457,422	2,253,241	207,447,099	98,502	4,005,427,094	94,936,539

Imports of selected agricultural products, 1851–1910—Continued.

Year ending June 30—	Beeswax.	Onions.	Plums and prunes.	Raisins.	Currants.	Dates.	Figs.
	Pounds.	*Bushels.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
1883	168,879	....	....	....	....	....	....
1884	48,123	....	60,600,228	53,702,220	....	....	7,945,977
1885	91,754	....	57,631,820	38,319,787	....	....	7,770,178
1886	26,546	....	64,995,545	40,387,946			7,223,070
1887	10,843	....	92,032,625	40,673,288	....	....	8,724,583
1888	51,702	....	70,626,027	40,476,763	....	....	10,058,053
1889	75,951	....	46,154,825	35,091,139	....	....	10,649,049
1890	126,319	....	58,093,410	36,914,330	....	....	10,284,998
1891	379,135	....	34,281,322	39,572,655	33,128,140	18,239,057	9,201,565
1892	271,068	....	10,869,797	20,687,640	36,665,828	17,084,557	8,338,759
1893	248,000	....	26,414,112	27,543,563	33,166,546	16,211,906	10,503,928
1894	318,660	....	9,908,122	13,751,050	52,664,843	12,408,192	7,985,959
1895	288,001	....	14,352,057	15,921,278	16,450,706	15,186,789	11,855,890
1896	273,464	....	483,658	10,826,094	33,040,846	13,680,302	11,900,710
1897	174,017	560,138	710,028	12,650,598	29,265,761	11,847,279	8,940,762
1898	272,097	488,853	303,992	6,593,833	25,186,210	13,561,434	9,628,426
1899	452,016	771,960	600,360	4,933,201	30,849,253	12,943,305	7,284,058
1900	213,813	546,798	443,457	10,309,498	36,251,779	19,902,512	8,812,487
1901	213,773	774,042	745,974	3,860,836	16,049,198	20,013,681	9,933,871
1902	408,706	796,316	522,478	6,683,545	36,238,976	21,681,159	11,087,131
1903	488,576	925,599	633,819	6,715,675	33,878,209	43,814,917	16,482,142
1904	425,168	1,171,242	494,105	6,867,617	38,347,649	21,058,164	13,178,061
1905	373,569	856,366	671,604	4,041,689	31,742,919	19,257,250	13,364,107
1906	587,617	872,566	497,494	12,414,855	37,078,311	22,435,672	17,562,358
1907	917,088	1,126,114	323,377	3,967,151	38,392,779	31,270,899	24,346,173
1908	671,526	1,275,333	335,089	9,132,353	38,652,656	24,958,343	18,836,574
1909	764,937	574,530	296,123	5,794,320	32,482,111	21,869,218	15,235,513
1910	972,145	1,024,226	....	5,042,683	33,326,030	22,693,713	17,362,197
Average:							
1886–1890	58,272	....	66,380,486	38,708,693	....	....	9,387,951
1891–1895	300,973	....	19,165,082	23,495,237	34,415,213	15,826,100	9,577,220
1896–1900	277,081	....	508,299	9,062,645	30,918,770	14,386,966	9,313,289
1901–1905	381,958	904,713	613,596	5,633,872	31,251,390	25,165,034	12,809,062
1906–1910	782,663	974,554	....	7,270,272	35,986,377	24,645,569	18,668,563

Year ending June 30—	Hides and skins, other than furs.			Macaroni, vermicelli, and all similar preparations.	Lemons.	Oranges.	Walnuts.
	Cattle.	Goat.	Other than cattle and goat.				
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
1895	....	54,240,492	172,335,253	....	....	....	....
1896	....	46,747,029	163,650,982	....	....	....	....
1897	....	49,868,020	156,232,824	....	....	....	....
1898	126,243,595	64,923,487	54,607,534	....	....	....	....
1899	130,396,020	69,728,945	66,965,785	....	....	....	....
1900	163,865,165	81,998,818	100,070,795	....	160,198,056	68,618,938	....
1901	129,174,624	73,745,596	77,989,617	....	148,514,614	50,332,914	....
1902	148,627,907	88,038,516	89,457,680	....	164,075,309	52,742,476	....
1903	131,644,325	85,114,070	102,340,303	28,787,821	152,004,213	56,872,070	12,362,567
1904	85,370,168	86,338,547	103,024,752	40,224,202	171,923,221	35,893,260	23,670,761
1905	113,177,357	97,803,571	126,893,934	53,441,080	139,084,321	28,880,575	21,684,104
1906	156,155,300	111,079,391	158,045,419	77,926,029	138,717,252	31,134,341	24,917,028
1907	134,671,020	101,201,596	135,111,199	87,720,730	157,859,906	21,267,346	32,597,592
1908	98,353,249	63,640,758	120,770,918	97,233,708	178,490,003	18,397,429	28,887,110
1909	192,252,083	104,048,244	148,253,998	85,114,003	135,183,550	8,435,873	26,157,703
1910	318,003,538	115,844,758	174,770,732	113,772,801	160,214,785	4,676,118	33,641,466
Average:							
1896–1900	....	62,653,260	108,305,584	....	....	....	....
1901–1905	121,598,876	86,208,060	99,941,257	....	155,120,336	44,944,259	....
1906–1910	179,887,038	99,162,949	147,390,453	92,353,454	154,093,099	16,782,221	29,240,180

Foreign trade of the United States in forest products, 1851–1910.

[Compiled from reports of Foreign Commerce and Navigation of the United States. All values are gold.]

Year ending June 30—	Exports.		Imports.	Excess of exports (+) or of imports (−).
	Domestic.	Foreign.		
1851	$4,188,635	$566,554	$1,332,522	+$3,422,667
1852	4,400,741	411,166	1,133,785	+ 3,678,122
1853	4,704,394	341,566	1.244,991	+ 3,800,969
1854	8,636,443	470,483	1,881,492	+ 7.225,434
1855	8,879,743	1,320,670	5.400,736	+ 4.799,677
1856	7,474,074	926,299	6,620,505	+ 1,779,868
1857	10,411,894	1,164,280	6,419,320	+ 5,156,854
1858	10,579,417	1,295,768	6,631,396	+ 5,243,789
1859	11,396,163	747,621	6,488,908	+ 5,654,876
1860	10,299,959	846,929	8,086,735	+ 3,060,153
1861	7,286,605	756,112	7,084,695	+ 958,022
1862	6,468,911	808,273	5,982,091	+ 1,295,093
1863	6,544,788	872,515	7,849,625	− 432,322
1864	6,608,236	616,086	10,401,691	− 3,177,369
1865	7,629,020	1,109,049	6,688,145	+ 2,049,924
1866	9,579,561	584,459	11,635,299	− 1,471,279
1867	11,175,119	599,918	12,975,903	− 1,200,866
1868	11,956,584	674,786	12,586,964	+ 44,406
1869	11,885,488	361,480	14,326,334	− 2,079.366
1870	11,984,445	1,181,708	17,555,708	− 4,389,555
1871	11,874,850	635,847	16,617,972	− 4,107,275
1872	16,494,184	1,004,495	19,402,210	− 1,903,531
1873	19,578,615	774,909	24,452,286	− 4,098,762
1874	21,143,701	1,116,763	21,468,824	+ 791,640
1875	16,680,377	1,019,887	17,295,187	+ 405,077
1876	15,636,980	883,254	16,023,785	+ 496,449
1877	18,312,446	532,547	15,386,709	+ 3,458,284
1878	17,180,147	705,941	16,344,201	+ 1,541.887
1879	16,023,005	557,434	18,745.076	− 2,164,637
1880	17,056,870	614,399	27,847,871	−10,176,602
1881	19,324,096	352,249	31,707.280	−12,030,935
1882	25,580.254	1,321,446	36,962,880	−10,061,180
1883	28,645,199	2,137,165	37.623,551	− 6,841,187
1884	26,222,959	1,450,032	35,931,961	− 8,258,979
1885	22,014,839	1,125,404	28,702,940	− 5,562,697
1886	21,061,708	1,052.083	32,042,431	− 9,928,640
1887	21,126,152	1,568,996	34,704,566	−12,009,418
1888	23,991,092	1,319,270	39,861,356	−14,550,994
1889	26,997,602	1,767,853	36,887,715	− 8,122,260
1890	29,473,084	1,337,677	40,010,518	− 9,199,757
1891	28,715,713	1,220,002	46,772,282	−16,836,567
1892	27,957,928	1,542,639	47,052,892	−17,552,325
1893	28,127,281	1,178,837	49,720,275	−20,414,157
1894	28,001,461	1,973,803	39,683,781	− 9,708,517
1895	28,576,680	1,277,705	43,302,134	−13,447,749
1896	33,718,790	2,563,550	45,696,324	− 9,413,984
1897	40,490,428	3,242,262	44,791,463	− 1,058,773
1898	38,439,418	2,582,082	45,751,938	− 4,730,438
1899	42,828,732	3,011,832	53,314,266	− 7,473,702
1900	52,676,575	3,981,002	60,633,078	− 3,975,501
1901	55,369,161	3,599,192	57,143,650	+ 1,824,703
1902	48,928,764	3,609,071	59,187,049	− 6,649,214
1903	58,734,016	2,865,325	71,478,022	− 9,878,681
1904	70,085,789	4,177,352	79,619,296	− 5,356,155
1905	63,199,348	3,790,097	92,680,555	−25,691,110
1906	76,975,431	4,809,261	96,462,364	−14,677,672
1907	92,948,705	5,500,331	122,420,776	−23,971,740
1908	90,362,073	4,570,397	97,733,092	− 2,800,622
1909	72,442,454	4,982,810	123,920,126	−46,494,862
1910	85,030,230	....	178,871,797	....
Average:				
1851–1855	6,161,991	622,088	2,198,705	+ 4,585,374
1856–1860	10,032,301	996,179	6,849,373	+ 4,179,107
1861–1865	6,907,512	832,407	7,601,249	+ 138,670
1866–1870	11,316,239	680,470	13,816,042	− 1,819,333
1871–1875	17,154,345	910,380	19,847,296	− 1,782,571
1876–1880	16,841,890	658,715	18,869,528	− 1,368,923
1881–1885	24,357,469	1,277,259	34,185,722	− 8,550,994
1886–1890	24,529,928	1,409,176	36,701,317	−10,762,213
1891–1895	28,275,813	1,438,597	45,306,273	−15,591,863
1896–1900	41,630,789	3,076,146	50,037,414	− 5,330,479
1901–1905	59,263,416	3,608,207	72,021,714	− 9,150,091
1906–1910	83,551,779	....	123,881,631	....

Exports of selected domestic forest products, 1851–1910.

Compiled from reports of Foreign Commerce and Navigation of the United States. Where figures are lacking, either there were no exports or they were not separately classified for publication.]

Year ending June 30—	Lumber.			Rosin.	Spirits of turpentine.	Timber.	
	Boards, deals, and planks.[a]	Shooks, other than box.	Staves.			Hewn.	Sawed.
	M feet.	*Number.*	*Number.*	*Barrels.*	*Gallons.*	*Cubic feet.*	*M feet.*
1851	100,604	....	....	387,220	363,828	....	....
1852	100,695	....	....	449,194	358,658	....	....
1853	78,599	....	....	454,715	634,371	....	....
1854	197,154	....	....	601,280	1,669,523	....	....
1855	144,718	....	....	731,060	2,339,138	....	....
1856	126,330	....	....	524,799	1,844,560	....	....
1857	309,165	....	....	641,517	1,522,177	....	....
1858	217,861	....	....	574,573	2,457,235	....	....
1859	197,099	....	....	798,083	2,682,230	....	....
1860	170,922	....	....	770,652	4,072,023	....	....
1861	132,332	....	....	536,207	2,941,855	....	....
1862	129,243	....	....	65,441	43,507	....	....
1863	135,901	....	....	17,025	58,565	....	....
1864	132,298	1,019,340	....	2,418	32,548	....	....
1865	172,644	1,043,797	....	11,232	51,863	....	....
1866	120,013	....	....	250,452	349,325	....	....
1867	131,666	....	....	334,104	1,513,225	....	....
1868	131,873	....	....	443,501	3,068,629	....	....
1869	134,370	....	....	585,989	3,184,955	....	....
1870	140,863	....	....	583,316	3,246,697	7,115,975	....
1871	154,830	....	....	511,959	2,453,554	7,115,007	....
1872	176,872	....	....	692,728	4,495,441	12,594,738	....
1873	236,557	....	....	845,162	5,114,653	14,154,244	....
1874	228,481	....	....	929,342	....	25,209,048	....
1875	213,974	....	....	937,527	5,599,624	13,553,714	....
1876	252,407	....	....	824,256	....	21,786,414	....
1877	321,530	....	....	....	6,796,927	20,640,259	....
1878	313,143	....	....	1,042,183	7,633,568	18,361,915	....
1879	275,102	....	....	1,112,816	7,575,556	13,255,241	....
1880	285,194	....	....	1,040,345	7,091,200	16,365,346	....
1881	320,602	....	....	1,023,710	6,595,528	22,961,618	....
1882	407,455	....	....	1,156,012	8,136,493	24,491,354	....
1883	499,406	....	....	1,347,256	9,867,344	19,913,220	....
1884	414,920	1,275,450	....	1,545,211	11,300,729	10,615,065	201,257
1885	412,424	1,281,571	....	1,269,304	8,987,226	8,411,066	153,248
1886	435,608	1,098,347	....	1,131,560	8,217,678	5,077,612	193,344
1887	424,760	902,269	....	1,365,012	10,209,883	4,260,639	167,609
1888	436,718	668,972	....	1,492,314	10,585,942	5,813,175	187,780
1889	571,075	543,597	....	1,420,218	9,681,759	6,301,065	252,996
1890	612,814	534,190	....	1,601,377	11,248,920	8,732,761	270,984
1891	613,406	316,242	....	1,790,251	12,243,621	6,900,073	214,612
1892	592,596	412,308	....	1,950,214	13,176,470	6,736,446	235,550
1893	629,355	385,863	....	2,059,407	13,415,459	7,836,921	214,198
1894	574,920	383,706	....	1,987,128	12,618,407	4,082,709	237,830
1895	588,781	352,928	....	1,862,394	14,652,738	6,039,539	297,693
1896	694,799	643,099	....	2,172,991	17,431,566	5,616,476	332,934
1897	876,689	695,858	....	2,429,116	17,302,823	6,406,824	391,291
1898	790,659	544,079	54,142,759	2,206,203	18,351,140	5,489,714	338,575
1899	970,170	616,380	44,382,689	2,563,229	17,761,533	4,796,658	406,448
1900	1,046,758	773,019	49,011,533	2,369,118	18,090,582	4,416,741	473,542
1901	1,101,815	714,651	47,363,262	2,820,815	20,240,851	4,624,698	533,920
1902	942,814	788,241	46,998,512	2,535,962	19,177,788	5,388,439	412,750
1903	1,065,771	566,205	55,879,010	2,396,498	16,378,787	3,291,498	530,659
1904	1,426,784	533,182	47,420,095	2,585,108	17,202,808	3,788,740	558,690
1905	1,283,406	872,192	48,286,285	2,310,275	15,894,813	3,856,623	486,411
1906	1,343,607	1,066,253	57,586,378	2,438,556	15,981,253	3,517,046	552,548
1907	1,623,964	803,346	51,120,171	2,560,966	15,854,676	3,278,110	600,865
1908	1,548,130	900,812	61,696,949	2,712,732	19,532,583	4,883,506	463,440
1909	1,357,822	977,376	52,583,016	2,170,177	17,502,028	2,950,528	383,309
1910	1,684,489	928,197	49,783,771	2,144,318	15,587,737	3,245,196	451,721

a Including "Joists and scantling" prior to 1884.

Exports of selected domestic forest products, 1851–1910—Continued.

Year ending June 30—	Lumber.			Rosin.	Spirits of turpentine.	Timber.	
	Boards, deals, and planks.	Shooks, other than box.	Staves.			Hewn.	Sawed.
Average:	*M feet.*	*Number.*	*Number.*	*Barrels.*	*Gallons.*	*Cubic feet.*	*M feet.*
1851–1855	124,354			524,694	1,073,104		
1856–1860	204,275			661,925	2,515,645		
1861–1865	140,484			126,465	625,668		
1866–1870	131,757			439,472	2,272,566		
1871–1875	202,143			783,344		14,525,350	
1876–1880	289,475					18,081,835	
1881–1885	410,961			1,268,299	8,977,464	17,278,465	
1886–1890	496,195	749,475		1,402,096	9,988,836	6,037,050	214,543
1891–1895	599,812	370,209		1,929,879	13,221,339	6,319,138	239,977
1896–1900	875,815	654,487		2,348,131	17,787,529	5,345,283	388,558
1901–1905	1,164,118	694,894	49,189,433	2,529,732	17,779,009	4,190,000	504,486
1906–1910	1,511,602	935,197	54,554,057	2,405,350	16,891,655	3,574,877	490,377

Imports of selected forest products, 1851–1910.

[Compiled from reports of Foreign Commerce and Navigation of the United States. Where figures are lacking, either there were no imports or they were not separately classified for publication.]

Year ending June 30—	Camphor, crude.	India rubber.	Rubber gums, total.	Lumber.		Shellac.	Wood pulp.
				Boards, deals, planks, and other sawed.	Shingles.		
	Pounds.	*Pounds.*	*Pounds.*	*M feet.*	*M.*	*Pounds.*	*Tons.*
1851	176,226						
1852	189,316						
1853	109,908						
1854	233,496						
1855	193,909						
1856	341,972						
1857	389,568						
1858	706,999						
1859	612,263						
1860	49,047						
1861	44,734						
1862	298,097	2,125,561	2,458,821			131,974	
1863	221,280	5,104,650	5,128,026			615,036	
1864	517,570			333		789,510	
1865	177,756					531,081	
1866	718,953		a 36,855	108,439		1,103,777	
1867	432,075		a 42,262	413,375		784,365	
1868	2,005	8,438,019	8,438,019	255,843		548,227	
1869			7,813,134				
1870			9,624,098				
1871			11,031,939	725,994			
1872			11,803,437	714,731	102,904		
1873	1,117,930		14,536,978	818,302	108,448		
1874	780,737		14,191,320	562,395	109,245		
1875	947,191		12,035,909	393,786	82,110		
1876	322,972		10,589,297	333,996	38,279		
1877	1,022,565		13,821,109	316,271	34,190		
1878	1,117,290		12,512,203	327,298	47,532		
1879	982,580		14,878,584	355,304	48,710		
1880	2,445,471		16,826,099	515,343	59,402		
1881	2,010,165		20,015,176	575,320	87,135		
1882	2,076,192		22,712,862	612,364	99,264		589
1883	2,312,166		21,646,320	572,099	104,657		
1884	2,047,732		24,574,025	600,762	86,219	2,865,753	7,491
1885	2,223,038		24,208,148	555,582	69,511	3,468,891	13,523

a Gutta-percha only.

Imports of selected forest products, 1851–1910—Continued.

Year ending June 30—	Camphor, crude.	India rubber.	Rubber gums, total.	Lumber.		Shellac.	Wood pulp.
				Boards, deals, planks, and other sawed.	Shingles.		
	Pounds.	*Pounds.*	*Pounds.*	*M feet.*	*M.*	*Pounds.*	*Tons.*
1886	1,133,913	....	29,263,632	547,832	79,150	4,396,431	10,139
1887	2,857,222	....	28,649,446	559,236	89,169	4,722,538	23,410
1888	2,779,719	....	36,628,351	608,743	161,715	4,206,850	35,133
1889	1,961,018	....	32,339,503	648,174	214,546	5,509,873	40,917
1890	2,055,287	....	33,842,374	660,327	194,168	4,739,465	43,478
1891	1,716,167	33,712,089	34,672,924	757,244	260,652	6,253,380	43,316
1892	1,955,787	39,976,205	40,284,444	663,253	363,027	6,310,266	41,118
1893	1,733,425	41,547,680	42,130,058	742,597	459,044	5,604,732	63,565
1894	1,323,932	33,757,783	34,256,546	514,619	378,632	4,868,681	35,587
1895	1,500,739	39,741,607	41,068,401	600,798	51,513	6,401,060	28,440
1896	945,629	36,774,460	40,618,314	786,209	....	6,056,957	45,143
1897	1,469,601	35,574,449	36,692,114	883,781	....	7,151,459	41,770
1898	2,047,234	46,055,497	46,691,974	353,215	435,421	6,984,395	29,846
1899	1,807,889	51,063,066	58,055,887	423,928	471,594	9,830,111	33,319
1900	1,789,580	49,377,138	58,506,569	680,226	541,040	10,621,451	82,441
1901	2,175,784	55,275,529	64,927,176	490,820	555,853	9,608,745	46,757
1902	1,831,058	50,413,481	67,790,069	665,603	707,614	9,064,789	67,416
1903	2,472,440	55,010,571	69,311,678	720,937	724,131	11,590,725	116,881
1904	2,819,673	59,015,551	74,327,584	589,232	770,373	10,933,413	144,796
1905	1,904,002	67,234,256	87,004,384	710,538	758,725	10,700,817	167,504
1906	1,668,744	57,844,345	81,109,451	949,717	900,856	15,780,090	157,224
1907	3,138,070	76,963,838	106,747,589	934,195	881,003	17,785,960	213,110
1908	2,814,299	62,233,160	85,809,625	791,288	988,081	13,361,932	237,514
							Pounds.
1909	1,990,499	88,359,895	114,598,768	846,024	1,058,363	19,185,137	614,244,972
1910	3,026,648	101,044,681	154,620,629	1,054,416	762,798	29,402,182	847,440,759
Average:							*Tons.*
1851–1855	180,571	....	....	....	....	....	....
1856–1860	419,970	....	....	....	....	....	....
1861–1865	251,887	....	....	....	....	....	....
1866–1870	....	....	5,190,874	....	....	....	....
1871–1875	....	....	12,719,917	643,042	....	....	....
1876–1880	1,178,176	....	13,725,458	369,642	45,623	....	....
1881–1885	2,133,859	....	22,631,306	583,225	89,357	....	....
1886–1890	2,157,432	....	32,144,661	604,862	147,750	4,715,031	30,615
1891–1895	1,646,010	37,747,073	38,482,475	655,702	302,574	5,887,624	42,405
1896–1900	1,611,987	43,768,922	48,112,972	625,472	....	8,128,875	46,504
1901–1905	2,240,591	57,389,878	72,672,178	635,426	703,339	10,379,698	108,671
1906–1910	2,527,652	77,289,184	108,577,212	915,128	918,220	19,103,060	252,077

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